Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

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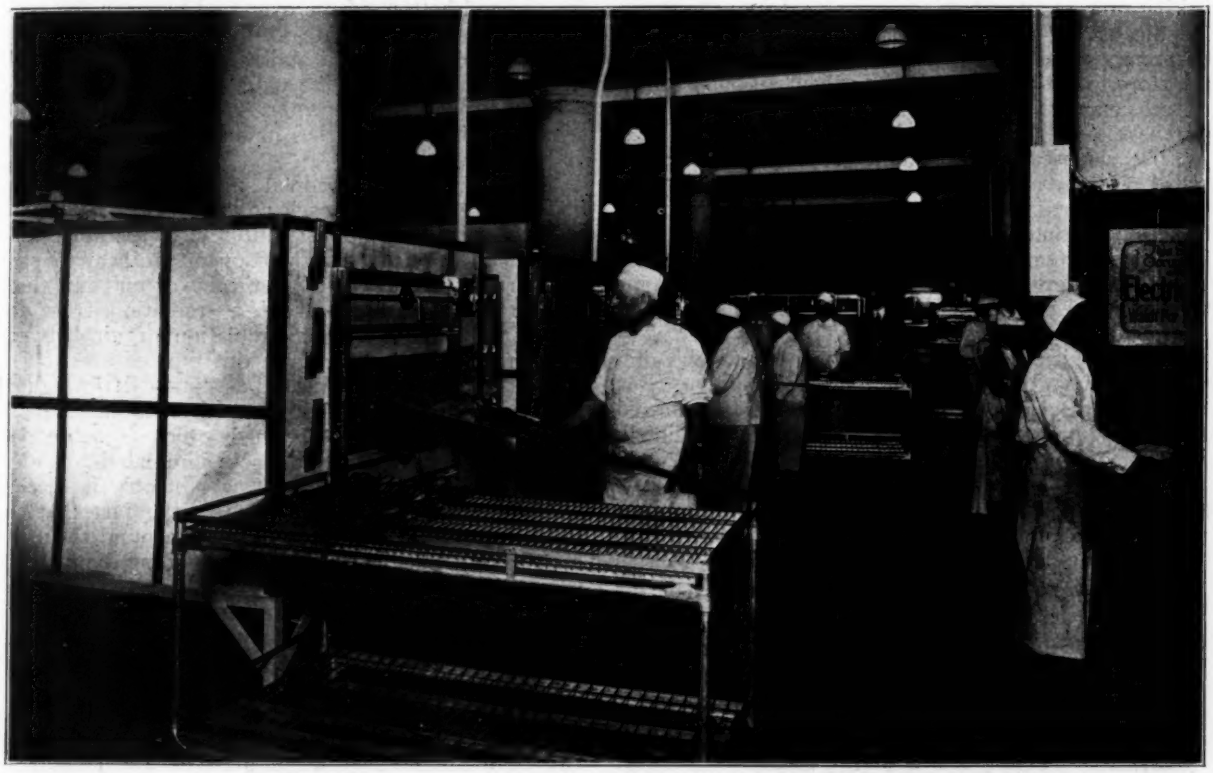


Front View of Electric Ovens in New Bakery at Rothschild & Co.'s Department Store in Chicago. From the Counter Shown at the Right the Customers Are Offered a Full View of the Operations.

Modern Electrical Bakery in a Large Department Store

Three Large Ovens and Other Equipment Electrically Operated in New Sanitary Bakery Prove Very Popular in Retail Merchandising Establishment of Rothschild & Company, Chicago

DURING the last few years progress has been made in the introduction of electric cooking and baking apparatus in commercial bakeries. One of the most complete of these bakery installations was recently placed in operation in the large department store of Rothschild & Co., at the corner of State and Van Buren streets, Chicago. This bakery is thoroughly modern, sanitary and efficient and uses electricity as the sole source of power for baking, frying, mixing and various other operations. It is under the supervision of R. W. Harris.

In size, if rated according to its production, this bakery is comparable with any except the larger commercial bakeries. This is evidenced by the average daily output which is, 3000 loaves of bread, 500 doz. rolls, 100 lb. of assorted cookies, 300 pies, 1500 to 2000 French pastries, 500 cakes of all descriptions and 2700 cream puffs. To accomplish this a force of 12 bakers is employed working in two shifts of 8 hours each.

If rated according to actual dimensions, however, the bakery is very small, occupying a space but 75 ft. by 55 ft. on the seventh floor of the store. This space includes, in addition to the baking and preparing

rooms, the sales counters over which the products are sold. This feature is especially important in an installation of this character for space in such stores is very valuable. Another important feature is the fact that the operation of this bakery does not raise any dust or soot and can be carried on, as it is, in the open store where the patrons may see for themselves how the work is done.

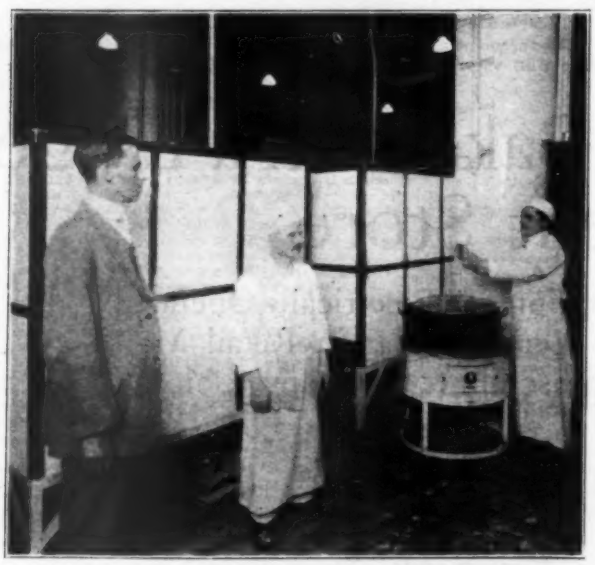
Its value as an advertisement is, of course, considerable. The demand for electrically prepared foods is very great and the spectacle of watching the actual baking process attracts many customers into the store. As the bakery is located on the seventh floor these customers must pass through a considerable part of the store to get to it, which gives them an opportunity to see many other articles which they need, and purchase.

The electrical equipment at present installed consists of three 25-kw. baking ovens, one 3.7-kw. doughnut stove, two 3480-watt hot plates, one 2-hp. flour mixer, one 2-hp. dough mixer and a 1-hp. cake mixer. The service for this equipment is supplied from the underground direct-current lines of the Commonwealth Edison Co., all of the machines being operated at 220 volts.

The service mains consist of 2 600,000 cir. mil. cables which are tapped off from a building riser supplying the elevators. These mains are connected to a distribution center located on a pillar immediately in front of the ovens. From this center four branch mains of 2 No. 0 cables each are taken. Three of these are run directly to the ovens and the other supplies another branch box from which are taken taps for the remainder of the equipment.

Description of Electric Ovens.

The most interesting and prominent part of the equipment is the baking ovens. These are of the Hughes portable-box type, manufactured by the Edison Electric Appliance Co., Chicago. Each oven contains three compartments which are 9 in. high, 56 in. deep and 57 in. wide. The three ovens occupy a space about 5½ ft. by 18 ft.



Electric Doughnut Stove Situated in Back of the Ovens.

The ovens have a surface capacity of 180 loaves of bread or the equivalent at one time. Their maximum temperature is 750° F., but they are seldom operated at over 550°—the ordinary temperature required for baking bread being between 550° and 450°. At this temperature the actual time required for baking bread is about 35 min. Allowing time for loading and unloading the ovens therefore, it is safe to assume that the turnover is one and one-half times per hour.

Each oven is equipped with four heating units composed of a number of helical coil units spirally would on Fireite tubes. These units are placed in the top and bottom of the oven and between the compartments. The units are so designed that more heat is developed at the front and rear of the oven than at the center, because of the tendency of these spots to become cooler than the center. Each unit is controlled separately by two switches having three heats each—full, medium and low.

These units are inbedded in fire brick or similar material which allows each compartment to be operated independently and at a different temperature than the others. The principal portion of the heat of each compartment is developed in the lower unit but there is also a slight downward heat radiation from the upper unit. There is no circulation of air between the different compartments in this type of oven. The perfect distribution of heat thus obtained throughout each compartment without air circulation, and the positive constant heat obtained which is subject to perfect control, with all hot spots eliminated, are ideal from the baker's point of view. Not only is there a considerable saving in time due to the fact that the product does not have to be shifted around to insure even baking, but the possibility of spoiling the material is greatly reduced.

Another prominent advantage is that the oven may be brought to the proper temperature in a very short time, and when once this temperature is obtained the heat recedes very slowly. By turning the switch to the full-heat position when starting work the oven is quickly brought to the desired temperature which can be maintained by keeping either the medium or low heat on during the balance of the day. The success of the oven depends to a considerable extent upon the proper utilization of the stored heat and upon the economic use of power by the correct setting of the switches. Very often, apples or other articles which bake slowly are placed in the oven when closing and left to bake in the slowly receding heat during the off-hours without using any power.

Other Electrical Equipment.

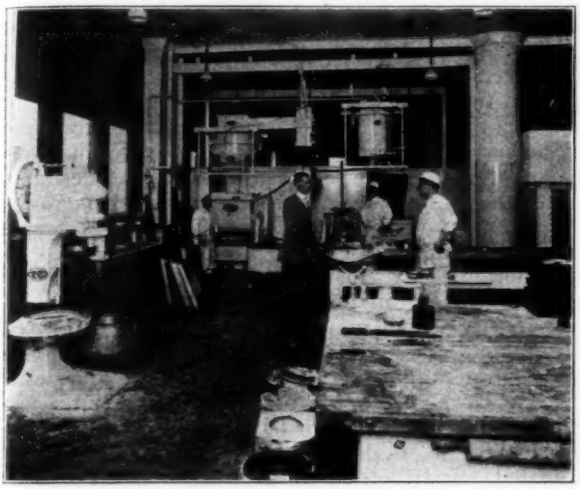
The doughnut stove also manufactured by the Edison Electric Appliance Co. consist of two cast iron heating units containing armoured sheath-wire elements, each unit controlled by a three-heat switch similar to those used on the oven. These units are very rugged and highly efficient. The doughnuts are placed in the wire holder, shown in the illustration and dipped into the pan of heated grease where they are left until completed. The stove is mounted on rollers and connected by a flexible cable to the branch circuit cabinet.

The dough, flour and cake mixers are manufactured by the Champion Machine Co. of Joliet, Ill. These machines are especially desirable for sanitary reasons and for their labor-saving qualities.

The hot-plates are used in the preparation of numerous articles which are not adapted to the ovens or doughnut stove. These plates contain three open coil, radiant units controlled by three-heat switches. They

are also the product of the Edison Electric Appliance Co.

The electric power consumption for the entire bakery thus far has averaged about 625 kw.h per day and it is expected that this will gradually increase to 1000 kw. per day. The estimated maximum demand is 60 kw. and occurs during the morning when the demand of the rest of the store is especially low. Practically no power at all is used during the peak period which occurs in the late afternoon as it has been



View of Mixing and Preparing Room Showing Installation of Modern Electrically-Operated Bakery Machinery.

arranged so that the bakers are changing shifts at that time.

The value of such a load to the central station is plainly evident. The total consumption in proportion to the maximum demand is very high being equivalent to more than ten hours use per day at the maximum demand. In addition it is a strictly off-peak load and may be easily regulated to conform with the central-station's requirements.

In this respect however, one feature must not be overlooked. The majority of bakers have been accustomed to using a coal or wood fuel oven in which large quantities of material were baked at one time. After one or two bakes with such ovens they are forced to remain idle until they could be reheated. With the electric oven the heat may be kept at a constant temperature for any desired length of time and it is to the advantage of both the baker and the central station to keep them in operation as continuously as possible. This of course means that an electric oven having a much smaller single capacity than the fuel oven should be used, and this feature must be remembered when designing an installation of electric ovens although some difficulty may be encountered due to the fact that many bakers will want a larger oven such as they have been accustomed to.

As was stated this is but one of the several comparatively recent installations of electrically-operated baking equipment for heavy duty work. The largest of these perhaps is in the plant of the Gooch Products Co. at Lincoln, Neb., where two 80-kw. ovens having a capacity of 600 1-lb. loaves of bread were installed. All these installations have proven very satisfactory to the baker in the quantity and quality of the product and the savings which are effected in fuel and labor, and to the central-station company as a highly desirable load.

THE J. E. ALDRED LECTURES AT JOHNS HOPKINS UNIVERSITY.

One Feature of General Plan for Improving Undergraduate Instruction.

Through the generosity of J. E. Aldred there has been founded in the Department of Engineering of Johns Hopkins University, Baltimore, Md., a course of lectures on engineering practice. The course of lectures is one feature of the general plan, made possible by Mr. Aldred's gift, for furthering and improving undergraduate instruction in the methods and problems of the practice of engineering. The lectures will deal with the practical phases of engineering problems, rather than with theory. They are not expected to discuss new and striking applications, as much as to deal with everyday working methods of design, construction and operation.

During the year three lectures each will be given in the general subjects—civil, electrical and mechanical engineering. They will be given on Wednesday afternoons at 4:45 o'clock, in the auditorium of the Engineering Building of the university, at Homewood. Although primarily for the students, the lectures are open to the general public and tickets of admission are not required.

Five lectures have already been given as follows: Feb. 5, "The Public Service Electric Power System," by Percy H. Thomas; March 5, "The Human Element in the Machine Shop," by James Hartness; March 12, "Berthing and Repair Docks for Shipping," by Rear Admiral Frederic R. Harris, U. S. N., retired; March 26, "Safety from the Standpoint of Industrial Efficiency," by C. W. Price, National Safety Council, Chicago, Ill.; April 2, "The Modern Steel Freight Ship," by D. D. Thomas, Baltimore Dry Docks & Shipbuilding Co., Baltimore, Md.

The remaining lectures are scheduled as follows: April 9, "The Duties of the Young Engineer on the Construction of a Hydroelectric Plant," by H. S. Slocum, consulting engineer, New York City; April 30, "The Production of 50% Ferro-Silicon in the Electric Furnace," by P. H. Falter, Shawinigan Electro Products Co., Baltimore, Md.; May 7, "Ore Docks on the Great Lakes," by John E. Greiner, consulting engineer, Baltimore, Md.; May 14, "Disturbing Currents in Telephone Systems," by John B. Taylor, consulting engineer of General Electric Company, Schenectady, New York.

TRANSMISSION OF COLORED LIGHT THROUGH FOG.

The Philadelphia Section of the Illuminating Engineering Society held a meeting on March 21 to hear a paper on "Transmission of Colored Light Through Fog" by Prof. C. L. Utterback, of the State University of Washington, which was presented by Prof. Thos. D. Cope, of the University of Pennsylvania. Dr. Cope discussed the paper from the standpoint of comparative results obtained by other investigators, and explained the significance of these various results as applied to practice. The interesting discussion which followed was participated in by the representatives of the professions and trades which have to deal with the problem of transmitting colored light through fog. Considerable difference of opinion was evidenced about the practical value of the results reported by the different experimenters.

Selection of Apparatus for Railway Converter Substations

Features Governing Choice of Types of Equipment for Direct-Current Railway Substations — Factors in Substation Design

By C. F. LLOYD

DIRECT-CURRENT railway substations are essentially very similar, since they all perform the same general functions, that is, supply power to propel cars and at the same time provide for safety, convenience in operation and economy. Necessarily, various substations differ widely in arrangement of details to best meet different local conditions. Naturally, it is the aim of every operating engineer to produce the substation most nearly approaching the ideal for his conditions at a minimum initial cost, to which end operating engineer and manufacturer must co-operate closely, which will materially reduce the necessity of building special apparatus and incidentally reduce the price of standard aparatus.

The synchronous converter is generally applicable and preferable to other classes of converting apparatus for railway service, requiring 600 and 1200 volts direct-current. This statement is made unreservedly, since the converter has proven its reliability from an operating standpoint while its efficiency including transformers is from 5 to 8% better than that of a similar motor-generator without transformers. In cases where a motor-generator requires transformers, a greater efficiency advantage is obtained from the converter outfit. The railway substation, at least for interurban work, operates at comparatively poor load-factor and in consequence, a further advantage is gained with the converter outfit, since a greater saving in efficiency obtains at the lighter loads.

Practically the only conditions which may preclude the use of the converter are, firstly, where alternating-current feeder line conditions are very poor, having, for instance, excessive ohmic drop, severe surges, wide frequency fluctuations, etc., on which synchronous apparatus would probably prove unstable, the induction motor-generator is the proper application. Today, this condition is rarely met, since a system to be consistently efficient, must afford alternating-current lines with comparatively little loss and be comparatively free from frequency variations, surges, etc. The choice in converting apparatus, therefore, usually narrows down to synchronous motor generators or rotary converters. Secondly, where the line power-factor is very poor it may be desirable to raise it with the converting apparatus, operating partially as a condenser. As the synchronous converter is purely a unity power-factor machine, a separate condenser is required to produce the same results as a synchronous motor-generator, having its motor designed to operate partially as a condenser. Where the first cost and efficiency of the converter with separate condensers are equal to or better than the first and motor-generator, the former is preferable.

Transformers.

The type of transformers selected depends almost entirely upon local requirements. The oil-insulated, self-cooled transformer is most universally used, especially in the smaller sizes on account of its simplicity and its not requiring any additional apparatus for cooling purposes. If water is to be had in sufficient quantity at little or no expense, it may become desirable to use the oil-insulated water-cooled transformer, except in the smaller sizes where this type of transformer is more expensive than the self-cooled. In some localities fire insurance rates are considerably reduced where transformers do not require oil. In cases of this kind, assuming voltages not to exceed 33,000 volts, the air blast transformer is used. This type of transformer may also be applicable and desirable in large sizes, from a cost standpoint, even though there is nothing to be gained by lower insurance rates. It is, however, a safe rule to use oil-insulated, self-cooled transformers, unless some marked advantage is to be gained, such as lower first cost or reduced insurance rates, by the use of one of the other types.

The phases selected may be dictated by local conditions. However, since the stationary transformer is possibly even more reliable than the synchronous converter, there is little to be gained by the use of single-phase in preference to three-phase transformers, unless the first cost is equal or less. Roughly, in the self-cooled type, there will be a saving in the three-phase transformer in voltages below 33,000 for converters up to 1000 kw. capacity. Above this size, single-phase are practically no more expensive than three-phase transformers and are, therefore, recommended. In the oil-insulated, water-cooled and air-blast, the three-phase transformer is always less expensive.

Reactance, either inherent or external to their transformers, is required by compound-wound railway converters for compounding purposes. Transformers with inherent reactance are recommended in preference to those with normal reactance and external reactance coils primarily due to lower initial cost.

Switching.

Upon the selection of switching equipment very often depends the success or partial failure of a substation. The switching equipment must be selected with a due regard for maximum simplicity, convenience and reliability. While essentially standard switching equipment is applicable in practically every case, there are, very often, local conditions which warrant and require additional protective apparatus for the best results. There is no universal rule to follow in the selection of switching equipment. It can only be selected by competent engineers after careful study of individual local conditions.

Alternating-current circuit breakers must be selected not only of sufficient ampere capacity, but must be capable of rupturing the maximum capacity available under short-circuit conditions. The likelihood of

short-circuit trouble between the high-tension breaker and the low-tension side of the converter is very remote; in fact, so remote, that protection for such an occurrence is not recommended. Consequently, the impedance in the converter transformer, should be taken into consideration in figuring the current under short-circuit conditions. Assuming, therefore, the standard converter transformer having 15% inherent reactance, the maximum line current that can be taken by a converter operating from this transformer, under short-circuit conditions, will be approximately seven times normal. A breaker capable of rupturing seven times normal three-phase line current is, therefore, recommended for the standard transformer and synchronous converter outfit.

Direct-current circuit breakers and switches are rated on the basis of the maximum current they will carry, for one hour or more, not to exceed temperatures approved by the Underwriters. Since standard converters are rated on the basis of 150% load for two hours the rating of the circuit breakers and switches should correspond to this value. The calibration range of the direct-current breakers should be considered, as it is good practice to set the machine breaker comparatively high, where automatic, with the feeder breakers set as low as practicable.

Meters should be carefully selected to meet the particular application requirements. Direct-current ammeter scale equal to the momentary swing capacity of the converter is recommended. It may, however, be desirable to shorten this scale in some cases in order to obtain better readings on average loads.

Ventilation.

Railway converters manufactured by the Westinghouse Electric & Manufacturing Co. have all been designed after careful study of the ventilation problem. It is particularly important on machines for this class of service, since they are often from necessity called upon to deliver very heavy sustained peak loads, which is possible only on well ventilated machines that quickly and efficiently radiate the increased heat generated if they are not to become dangerously hot. Further, the very open construction with thin copper cross sections, especially in field winding, necessary to obtain maximum ventilation, makes it possible to observe accurate temperatures and to know how hard the machine can be worked in emergency.

Foundations.

All converters are self-contained, except where desired in the larger sizes of 1500 kw. and above, the bedplates may be omitted at a slight saving and sole plates supplied instead. Sole plates which are bolted and grouted into the foundation are supplied—two for the frame and one for each bearing pedestal. The converter pedestals are then lined up and bolted to the sole plates. All self-contained converters are equipped with a heavy cast iron bedplate. It is only necessary to grout the bedplate machines to the foundations and the bedplates are consequently not drilled for foundation bolts, as they are not required. Good stable foundations are required for all types of machines, it, of course, being necessary to supply an especially good foundation for sole plate machines.

Starting.

Standard synchronous converters are suitable for either alternating or direct-current self-starting. The alternating-current self-starting method is recommended on account of its simplicity, due primarily to the elimination of synchronizing. The objection on account of excessive starting kilovolt-amperes required is practically eliminated, due to larger capacities behind the machines and because the self-starting machine as now built requires very low starting kilovolt-amperes. This is accomplished by the use of a very

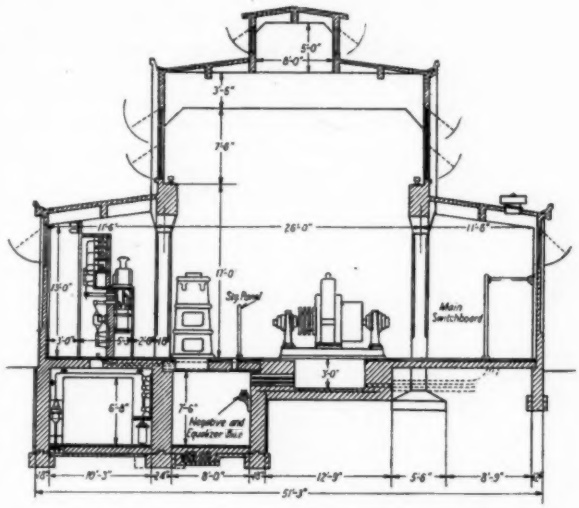


Fig. 1.—United Railways & Electric Co.'s Bevidere Substation Typifies Good Layout of Substation With Underground Incoming Transmission Lines.

effective cage winding located in the pole faces. The efficient manner in which the copper of this winding is distributed over the pole faces renders it, if possible, a more efficient damping winding, which is the heart of stable operation, incidentally meaning successful and reliable operation. The shunt field is controlled by a two-pole double-throw field switch, usually mounted on the alternating-current starting panel, with discharge clip and resistance, by which the polarity is reversed when necessary. During starting, the field switch should be in the closed position, thus short-circuiting the field through the armature. This method of handling the shunt field not only reduces the strain on the field insulation over that obtained with the old field break-up switch with its unsightly frame wiring, but is a great convenience to the operator in starting machines quickly.

Regulation and Compounding.

Compound-wound converters are recommended for railway work, primarily because their regulation is superior, and parallel operation is more readily affected than with shunt-wound machines. The regulation of a compound converter depends upon three factors, namely: series field, reactance and ohmic drop between the source of power and the converter. Compounding is not obtained directly by change in series field as in a direct-current generator, but by changing the machine power-factor, which causes any reactance volts behind the machine to be added to or subtracted from the voltage actually applied to the converter collector. The direct-current voltage from no load to full load will be raised, neglecting the drop in the converter due to load in the same percentage as the voltage is increased at the collector. The alternating-current ohmic drop between the source of power and the converter is directly opposed to compounding and should it amount to the same percentage as the percentage increase, then a practically constant voltage will result.

The standard method of compounding converters is to adjust the machine shunt field to a value such that when fully loaded with the series field in circuit, it will be operating at approximately unity power-factor. The applied voltage to the collector rings therefore, at light loads, with the lagging power-factor, is reduced as the reactance volts subtract from the generator volts, while at full load unity power-factor the current is in phase with the impressed voltage and the impressed volts are almost equal to the generator volts.

It is practically impossible to correctly determine the values necessary to figure the regulation that will obtain in individual cases, consequently, converter regulation cannot be predicted with any degree of accuracy. Standard converters of the company with which the writer is identified are designed with a reasonably heavy series field and their transformers with 15% inherent reactance, which is the maximum reactance consistent with good practice. Such a combination will give approximately constant voltage from no load to full load, providing the voltage is practically constant at the high tension side of the transformers.

The best results are obtained with slightly dropping voltage characteristics at substations. This means that the converter should be under-compounded in amount depending upon local conditions. Invariably it is good practice to shunt the converter series field to obtain a drop in excess of that which may be due to alternating-current line drop. This adjustment allows better distribution of load between substations and, in consequence, better results are obtained when cars become blocked for some abnormal reason.

Substation Building.

When drawing up plans for a substation building, full consideration should be given the following design factors:

1. The arrangement of the apparatus should be made to economize space and reduce to a minimum the quantity of low tension cables required. On the other hand, sufficient space must be allowed around the apparatus to prevent interchange of radiated heat, for efficiently cleaning and for making repairs.

2. Careful study of the ventilation problem must be made, as it is just as important in this class of building as in an office building. Good ventilation but very slightly increases the cost of the building and materially increases the life and output of the apparatus. It increases the efficiency of the transforming and converting apparatus, since copper losses are reduced at lower temperatures and often conditions are such that the load-factor can be improved. It also improves the efficiency and alertness of the operators.

The ideal system of ventilation is to take the air in at the base of the machines or transformers and allow it to pass out through the roof by means of monitor construction or metal ventilators. The velocity of the warm air rising from the apparatus depends upon the difference in temperature between the incoming and the outgoing air and the height of the openings for the exit of the air above the floor. Consequently, the height of the exit openings must be considered, although usually the required head-room will place these openings sufficiently high to use this ven-

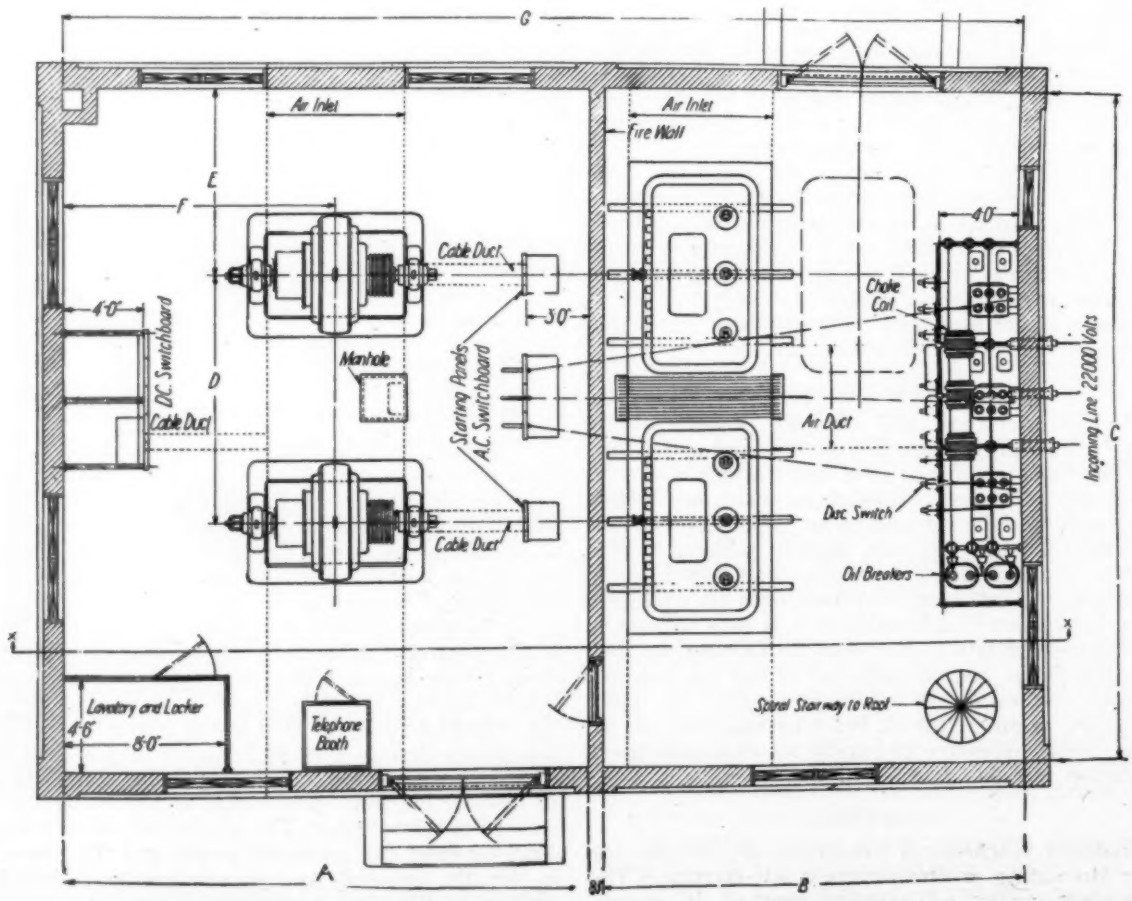


Fig. 2.—Typical Standard Railway Substation Layout Upon Which Are Based Dimensions Given in Table.

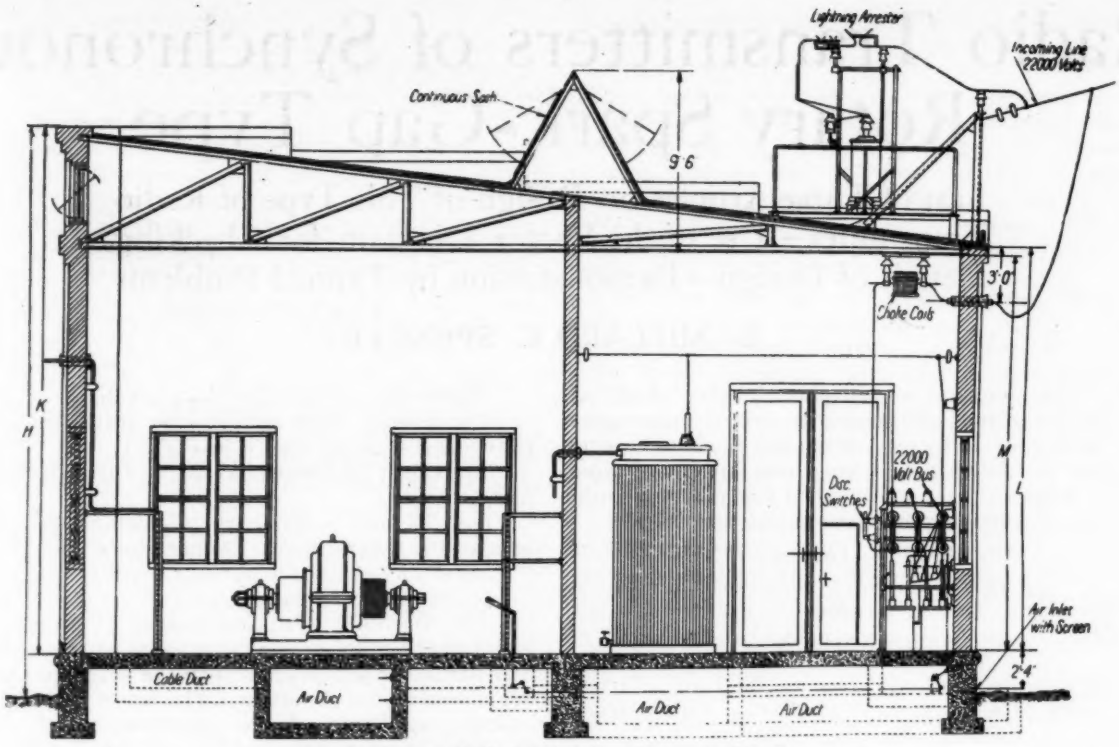


Fig. 3.—Section X-X of Substation Shown in Fig. 2.

tilating scheme efficiently. Unlike the old window method of ventilation, this scheme is possible during all kinds of weather.

3. Noise from the machines, especially where substations are located in resident districts, is a point for consideration and it may become so great as to become a decided nuisance, rendering it possible for neighbors to obtain injunctions, causing a substation shut-down.

cases, it is probably better to use a separate lighting transformer. The arrangement of the lights should be made with particular reference to the easy reading of switchboard meters, transformer and machine bearing oil gauges, thermometers, etc.

5. The building should be constructed throughout on a fireproof basis, with every arrangement practicable to protect one piece of apparatus from another

SYNCHRONOUS CONVERTER SUBSTATIONS FOR SMALL UNITS.

TABLE OF DIMENSIONS—600 VOLTS, D. C.—22,000 VOLTS, 60 CYCLE, A. C.

Size	A		B		C	D	E		F		G	H	L	M	
	ft.	in.	ft.	in.	ft.	ft.	ft.	in.	ft.	in.	ft.	ft.	ft.	ft.	in.
300	17	0	13	3½	24	9	7	6	11	9	31	25	19	18	6
500	18	3½	15	0	24	9	7	6	12	0	34	27	21	20	6
750	22	0	17	3½	27	9	9	0	12	9	40	27	21	20	6
1000	23	0	20	3½	33	12	9	0	13	4	46	28	22	21	6

The old method of using open windows and doors for ventilation is not only objectionable in many localities due to the deposit of dust blown in on the rotating apparatus, but due to noise. The ventilation scheme recommended above is particularly recommended from the noise standpoint.

4. While the window area should not be excessive, the building should be well lighted by day in all parts to facilitate repairs so that all corners, pits, etc., can be readily observed and thereby kept clean. The use of ribbed glass is very desirable, as it eliminates the glare of the sun, making it easier to read instruments, gauges, etc. Artificial illumination should approach the natural lighting, as very often repairs have to be made at night. It should preferably be obtained by the use of lamps in large units with suitable diffusers. In 600-volt substations, a cluster of small lamps can be substituted, thereby avoiding the use of a special lighting transformer. This same arrangement can be used for 1200 or 1500-volt substations, but except in rare

and to protect all from external fire communications. In some cases, it may be desirable on account of insurance rates, or for a greater insurance to continuous operation, to increase the cost of the substation building by the cost of a fire wall to isolate the transformers and oil switches from the synchronous converters and switchboard.

6. Every provision should be made for a possible extension of the substation, even though it appears that no future extensions will be necessary at the time the design is made. This refers to a symmetrical arrangement of the apparatus on the unit system and the proper construction of roof framing to make such extensions feasible.

7. The building should be simple and substantial with just sufficient paneling on the exterior to relieve the monotony of a plain wall. An attractive building can be built at the same cost as an unattractive and poorly designed one if sufficient attention is given to this point.

Radio Transmitters of Synchronous Rotary Spark-Gap Type

Last of Three Articles on Design of This Type of Radio Transmitter—Use of the Vector Diagram for Checking Details of Design—Demonstration by Typical Problems

By MILLARD C. SPENCER

IN THE first and second parts of this article we have discussed the general theory of radio transmitters of this type, developed a simple vector diagram for showing the voltage and current relations of the different parts, and applied this diagram to the analysis of tests of radio transmitting apparatus.

Part 3—Design.

The application of this vector diagram to the actual design of radio transmitters can perhaps best be shown by means of a few numerical examples.

Problem No. 1.

Let it be required to determine the ratio of transformation of a transformer to operate with a generator having the following characteristics:

Output 250 watts.
Current rating 6.0 amperes.
Frequency 1000 cycles per second.
Synchronous impedance 17.0 ohms.
Saturation curve as given in Fig. 12.
Armature resistance 1.25 ohms.

It is further assumed that for the purpose of operating at a certain definite wave length it is desired to use a condenser of 0.004 mf. capacity. The rotary spark gap is to be arranged to give one spark per cycle.

The data required for constructing the triangle AOB of the vector diagram of Fig. 13 may be calculated at once as follows:

$OA = IR_g = 6.0 \times 1.25 = 7.5$ volts.

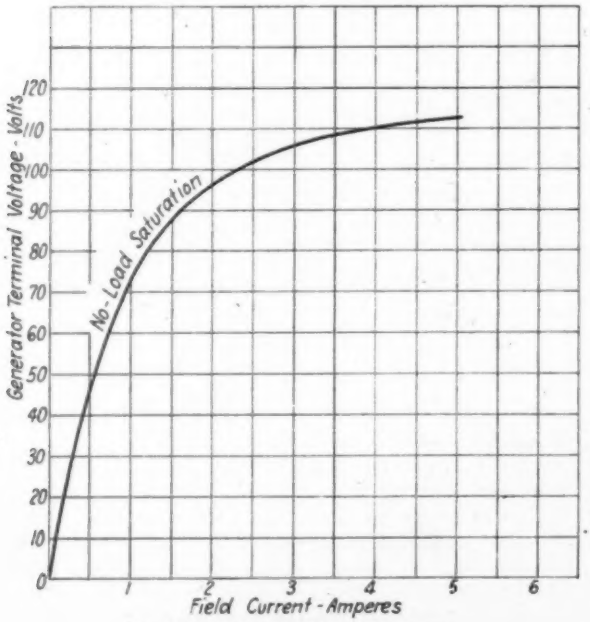


Fig. 12.—No-Load Saturation Curve.

$AB = IX_g = 6.0 \times 17.0 = 102$ volts.

The triangle AOB may now be drawn in, to some convenient scale, as shown in Fig. 13.

Equivalent load resistance $R_1 = 250/(6.0)^2 = 6.94$ ohms.

For the first preliminary calculations the impedance of the transformer is assumed to be equal to zero.

$BG = IR_1 = 6.0 \times 6.94 = 41.7$ volts.

BG is drawn in parallel to OI.

The line OM is drawn making the angle MOI equal to about 30°. The exact value of this angle for any particular set depends upon the speed and voltage regulation of the generator. The better the speed and voltage regulation of the generator, which can be depended upon in actual service, the smaller this angle can be made and, in general, the smaller this angle the higher will be the efficiency of the set.

A perpendicular is drawn downward from G, cutting the line OM at H. By actual measurement on the diagram it is found that $GH = 74$ volts.

Since $GH = IX_c = 74$

$X_c = 74/I = 74/6.0 = 12.3$ ohms the effective value of the condensive reactance required.

As found in Part 2, the value of the constant k for a transmitter arranged to give one spark per cycle was equal to 0.60.

Therefore since $X_c = kX_{cp}$

$X_{cp} = 12.3/0.60 = 20.5$ ohms the apparent value of the condensive reactance required.

Substituting in equation (2) of Part 1,

$X_{cp} = 20.5 = 10^6 \div (2 \times \pi \times 1000 \times C_p)$

$C_p = 7.78$ mf.

By substituting this value and the specified value of the secondary condenser, $C_s = 0.004$ mf., in equation (1) Part 1 the value for the ratio of transformation of the transformer is obtained as follows:

$C_p = C_s N^2$

$N = \sqrt{C_p \div C_s} = \sqrt{7.78 \div 0.004} = 44.2$

Having obtained this approximate value of the transformer ratio, the transformer should then be designed, its impedance determined, and the above calculations repeated, taking into account this impedance. If the transformer has a large impedance it may then be found necessary to make some small change in this ratio.

Problem No. 2.

Let it be required to determine the specifications for a generator to operate with the following radio transmitting apparatus:

High-voltage condenser 0.012 mf. capacity.
Transformer having the following characteristics:
Output 500 watts.
Ratio of transformation 30: 1.
Current capacity of low-voltage winding 8.0 amperes.

Frequency 1000 cycles.
Resistance of low-voltage winding 0.20 ohms.
Resistance of high-voltage winding 290 ohms.
Total leakage reactance 0.5 ohms (expressed in primary terms).
Adjustable reactance coil.
Maximum reactance 4.5 ohms.
Total resistance 0.3 ohms.

From the above data the values necessary for constructing the vector diagram of Fig. 14 may be obtained as follows:

Substituting in formula (1) Part 1,
$C_p = 0.012 \times (30)^2 = 10.8$ mf.
From formula (2) Part 1,
$X_{cp} = 10^6 \div (2 \times \pi \times 1000 \times 10.8) = 14.75$ ohms
From equation (3) Part 1,
$X_c = 0.60 \times 14.75 = 8.85$ ohms effective condensive reactance expressed in primary terms. (The constant k is taken as equal to 0.60 as the rotary gap is to be arranged to give one spark per cycle.)
$IX_c = 8.0 \times 8.85 = 70.8$ volts.
in, to some convenient scale used throughout the diagram, equal to 70.8 volts.
$R_l = 500/(8)^2 = 7.82$ ohms equivalent load resistance.
$IR_l = 8.0 \times 7.82 = 62.5$ volts.
From point G the line GF is drawn equal to 62.5 volts.

The triangles FED and DCB are drawn from the following data:

$IR_t = 8.0 \times 0.522 = 4.2$ volts.
$IX_t = 8.0 \times 0.50 = 4.0$ volts.
$IR_r = 8.0 \times 0.30 = 2.4$ volts.
$IX_r = 8.0 \times 4.50 = 36.0$ volts.

From point H a line HP of indefinite length is drawn making an angle of 35° with the horizontal xy. From point B a perpendicular is dropped cutting the line HP at O. The line DC is extended to cut the line HP at N. Lines from B and D are drawn to H. The diagram is now complete, provided the internal generator resistance drop is neglected, which in any practical case will have but very small effect on the final results.

With all the reactance coil in the circuit the required generator characteristics may be determined as follows:

$OB = 79 = IX_g$
Therefore the required generator synchronous impedance = 79/8.0 = 9.9 ohms. The required internal generated voltage = OH = 84.3 volts. The generator terminal voltage on full load = BH = 75.7 volts. Power-factor of load at generator terminals = cos $\angle HBC$ = cos 24° = 0.91 or 91% *leading*. Required generator output = $BT \times I = 69.1 \times 8.0 = 552$ watts.

With the reactance coil cut out of the circuit the required generator characteristics are:

Generator synchronous impedance = DN/I = 113.5/8.0 = 14.2 ohms. Internal generated voltage = NH = 81.3 volts. Generator terminal voltage = DH = 94.3 volts. Power-factor of load at generator terminals = cos. $\angle HDE$ = cos. 45° = 0.71 or 71% *leading*. Generator output = $DU \times I = 67.7 \times 8.0 = 542$ watts.

Since the reactance coil is adjustable, if the generator characteristics fall within the limiting sets of values determined above, then by means of this reactance coil the set can be adjusted for satisfactory operation.

The specifications for the generator would therefore be as follows:

Output 550 watts.
Frequency 1000 cycles per second.
Current capacity 8.0 amperes.
Internal generated voltage 85 volts.
Synchronous impedance between 9.9 and 14.2 ohms.
Power-factor of load 91% leading to 71% leading, depending upon the synchronous impedance of the generator.

Correction.—Through a printer's mistake not discovered in time, the no-load saturation curve (Fig. 12) appearing on page 542 was used on page 497 of Part 2 in place of Fig. 4. The latter is very similar to Fig. 12 in shape but reaches its maximum value of 323 volts at 1.28 amperes.

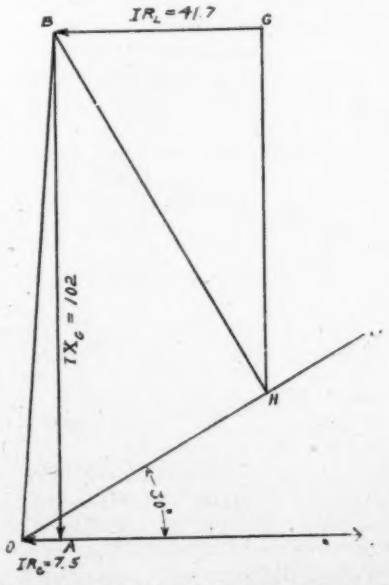


Fig. 13.—Vector Diagram Used in Determining Transformer Ratio.

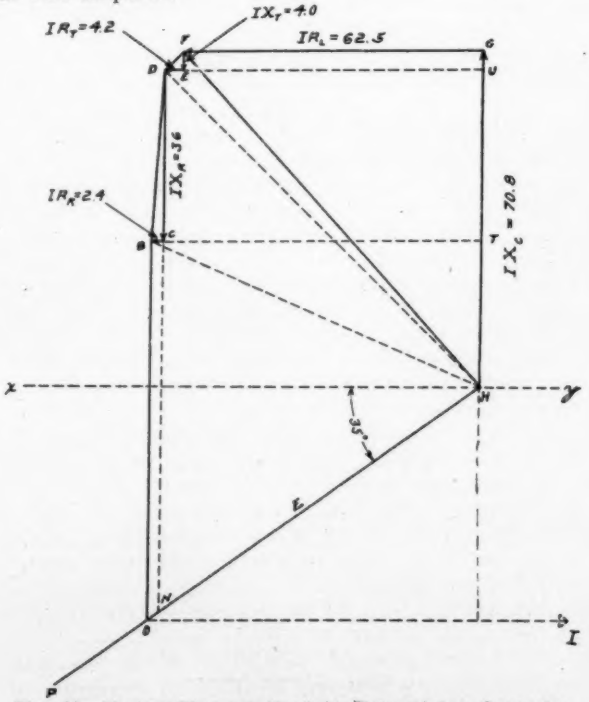


Fig. 14.—Vector Diagram Used in Determining Generator Specifications.

Contractor-Dealers Adopt Standard Accounting System

New System Recommended by National Association of Electrical Contractors and Dealers Offers Many Advantages—Brief Description of Principles and Forms

AT THE recent convention of the Wisconsin State Association of Electrical Contractors and Dealers, J. E. Sweeney, of Waterloo, Ia., chairman of the Credit and Accounting Committee of the National Association, delivered a very instructive address describing the new accounting system for electrical contractor-dealers. A brief report of Mr. Sweeney's talk was republished in the March 29 issue of the ELECTRICAL REVIEW in connection with the report of the convention.

The new system is the result of the combined efforts of the Credit and Accounting Committee of the Association and similar committees of other associations connected with the industry. It bears the endorsement of the National Association of Electrical Contractors and Dealers, the National Electrical Credit Association, the Electrical Supply Jobbers' Association, the Associated Manufacturers of Electrical Supplies and numerous other electrical organizations. It was developed with the intention of supplying the contractor-dealer with a modern standard system of accounting which will enable him to keep a much closer account of business, which in turn will have a tendency to stabilize conditions to a considerable extent.

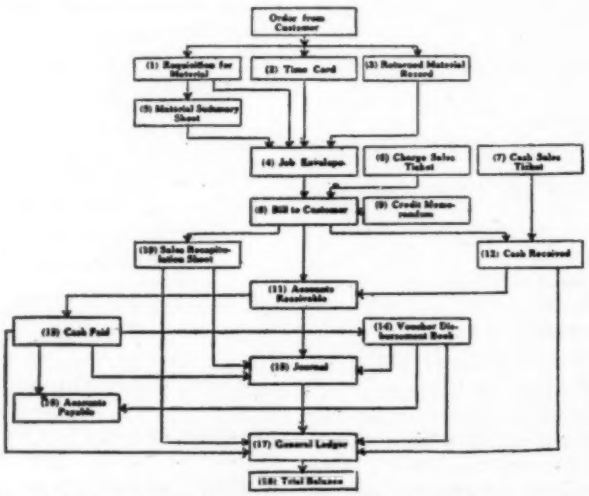


Chart of New Accounting System for Contractor-Dealers Showing Sequence of Accounting Operations.

Special attention was paid in the development of the system to have it as simple as possible so that it could be applied without any great difficulty to replace existing systems. The system as it stands consists of 18 forms each designed to be used for a separate purpose. The more important of these forms and those which were specially designed for use in this system are reproduced herewith. For four others, namely, 6, 7, 8, and 9, no special form is recommended and the contractor-dealer is expected to use his present forms for their purposes. The general ledger, 17, and the trial balance, 18, are arranged in book form according to the most modern practice. The use of the different forms and their sequence is shown graphically in the chart. The system is designed for use by contractors whether a retail business is carried on in connection with their contracting business or not, but where a retail business alone is carried on, the first five forms are not needed.

The system is based upon six cardinal principles and a clear understanding of these is necessary in order to derive the full benefits of it. These principles are briefly summarized as follows:

1. All forms should be standardized. The advantage of this is that, aside from the saving effected in price and delivery by having these forms supplied from a central source, the contractor-dealer will have on hand all the essential facts of his business through a uniform procedure and be able to make comparison statistically with others in the same line of business as he is.

2. All sales, whether contract, jobbing, day work or retail, should be costed. By this the contractor-dealer at any time will know the exact state of his finances and whether or not any certain job, appliance or department of his business is making or losing money for him.

3. A merchandise account should be created through debit entries for purchases and credit entries at cost for material sold in any way. Through this account, the contractor-dealer is enabled to tell at any time the value of the stock on hand, the rate of turn-over, the proper amount of insurance to carry, etc.

4. A general ledger containing all controlling accounts should be made part of the system. Most contractors already keep a book of this sort where they assemble in a condensed form information regarding assets and liabilities.

5. All liabilities should be vouchered each month irrespective of receipt of goods or correctness of invoice, provision being made for charging vendors for any discrepancy in invoices. This is a practical arrangement to insure getting every liability properly entered and accounted for, thus preventing disputes with people from whom purchases are made.

6. The cash book should combine the records, both receipts and disbursements—that is, debit entries equalizing bank deposits for the month and credit entries equalizing charges to bank balance. This will serve to keep the contractor-dealer in touch with his bank account and tend to systematize and prevent leaks in the business. The cash book should not be used for distribution.

In order that every member may have an opportunity to properly acquaint himself with the system, the National Association is arranging for a series of illustrated lectures to be presented at the various district and section meetings of contractor-dealers. In addition a very comprehensive and complete description of the system including the proper method of

application appears in the April issue of the *Electrical Contractor-Dealer*.

Sets of these forms, containing a sufficient number of each for an average size contracting business have been prepared and are being distributed by the National Association of Electrical Contractors and Dealers, 110 West 40th street, New York City. The cost of these sets to member companies is $25 each, f.o.b. shipping point. Arrangements have been made with the publishers to have these sets shipped from several cities throughout the country. Contrary to the former custom of supplying sets to member companies only, these sets are also available to non-member companies at the slightly increased price of $40

Requisition for Material

No. Date
Charge to Job No. From Stock? From Vendor?
Roughing Finishing Tools
Name
Address

Quantity	Date Delivered	Material	Cost

Remarks Total
Rec'd by

Form 1. Requisition for Material. This Form Provides a Record of Material Sent to a Job Either from the Warehouse or from the Jobber or Manufacturer Direct. Spaces Are Provided in the Heading for Miscellaneous Information Concerning the Job.

Returned Material Record

No. Date
Credit to Job No.
Roughing Finishing Tools
Name
Address

Quantity	Material	Cost

Remarks Total
Rec'd by

Form 3. Returned Material Record. Use of This Form Enables the Contractor to Check the Quantity of Material Actually Used on Any Job.

Material Summary Sheet

Job No. Name Address

Date	Amt.	Date	Amt.	Date	Amt.	Date	Amt.	Date	Amt.	Total	Credit on Returns	Total	Material	#	Cost	Selling

Form 5. Material Summary Sheet. The Purpose of This Form Is to Keep Record of the Total Amount of Material Sent Out for Any Job on Different Material Requisitions.

Time Card

Date

I worked to-day as follows:	Job No.	Car Fare	Telephone	Rate	Hours

Signed

Form 2. Time Card. This Form Is Filled Out Daily by the Workman and Permits an Easy and Accurate Method of Computing Labor Charges.

Job Envelope

Job No. Date
Amount of Contract Customer's Order No.
Name
Address
Date Billed Total Cost

Material			Labor			Direct Job Expense		
Req. No.	Amount	Total	Date	Amount	Total	Date	Amount	Total
Total			Total			Total		

Form 4, Job Envelope. In This Envelope Should Be Kept All the Records of Any Particular Job. It Is Substantially Constructed of Heavy Paper and Spaces Are Provided for Information Concerning the Job on the Front.

Accounts Receivable

Name
Address

Date	Folio	Debits	✓	Date	Folio	Credits	✓	Balance

Form 11. Accounts Receivable. This Form Is Used for Keeping a Record of Unpaid Charges.

Sales Recapitulation Sheet

For month of

Customer's Bill No.	Job No.	CONSTRUCTION SALES: Mdse. Cost	Labor Cost	Direct Job Expense	Cost of Sales	Sales Billed	LAMP SALES: Cost of Lamp Sales	Lamp Sales Billed	STORE SALES: Cost of Store Sales	Store Sales Billed	SALES: Cost of	Billed

Form 10. Recapitulation Sheet. When Properly Used This Sheet Will Furnish the Contractor-Dealer with a Record of the Total Sales for Any Month Together with the Cost of Such Sales.

per set, f.o.b. shipping point. Applications for these sets should be made to W. H. Morton, general manager of the association at the above address.

Cash Received

Date	Name	Folio	Accounts Receivable	Cash Discount Allowed	General Ledger	Cash Sales	Bank	Bank

Form 12. Cash Received. This Form Is Used for Entering Items of Cash Received and Their Disposition.

Dr. **Journal** *Cr.*

Misc.	General Ledger	Accounts Payable	Accounts Receivable	Folio	Name	Name	Folio	Accounts Receivable	Accounts Payable	General Ledger	Misc.

Form 15. Journal. This Form Is to Be Used for All Transfers from Debit to Credit of Any Accounts Receivable and Payable or General Ledger.

Accounts Payable

Name _____

Address _____

Date	Folio	Debit	Date	Voucher No.	Credit	Credit Balance

Form 16. Accounts Payable. This Is a Loose Leaf Form for Keeping Account of the Credit and Debit Entries for Any Single Vendor.

REPORT OF THE WATER POWER RESOURCES OF MAINE.

Public Utilities Commission Distributes Detailed and Complete Report of Water Power Conditions.

The report for 1918 of the Public Utilities Commission of the State of Maine which is the report of a special water power investigation in that state is a volume which reflects great credit on that Commission. The fact that the report was ready for distribution at the instant at which water power development was being discussed in Congress shows that the Commission was familiar with the necessity of water power development before other Commissions were familiar with that necessity. Besides being timely, the report, which is detailed and complete, not only makes public a mass of information that will be valuable to the people of Maine, but also establishes a sort of standard that will prove valuable to the Commissions of other States who intend to make similar reports.

The report embraces three general phases of the water power situation in Maine, namely, the legal phase, the engineering phase, and the administrative phase. Necessarily, the engineering phase occupies more of the volume than the other phases. The legal phase consists of a brief and well written review of decisions affecting water rights and of the limitations in the exercise of the right of eminent domain within the State. The engineering phase consists of a large amount of data of rainfall, runoff, storage areas, and elevations. These data, which are tabulated, are reduced to second feet per square mile. The third phase is of unusual interest since it consists of a discussion of all the features and problems necessary to be considered by the administrative officers of a power-developing concern. It consists of a comprehensive discussion of cost distribution, of units of power, of the general factors affecting the cost of power, and of rates charged in various parts of Maine.

Cash Paid

Voucher Number	Check Number	Date	Name	Folio	Accounts Payable	Discount Earned	Bank	Bank Balance	Bank	Bank Balance

Form 13. Cash Paid. Entries Are Made on This Form of Cash Paid Out and a Record Kept of Bank Balances, Etc.

Voucher Disbursement Book

CREDIT				DEBIT												
Name	Voucher No.	Folio	Accounts Payable	Mdse.	Labor	Direct Job Expense	Folio in Gen'l Ledger	General Ledger	Salaries	Transportation	Stat. and Office Supplies	Warehouse Expense	Tel. & Tel.	Postage	Automobile	Misc.

Form 14. Voucher Disbursement Book. All Vouchers to One Person or Firm Are Assembled and Entered on This Form Monthly for Totaling.

CENTRAL-STATION STATISTICS FOR TEN STATES GIVEN OUT.

The preliminary figures of the forthcoming quinquennial report on the central electric light and power stations for ten more states have been given out by Director Sam L. Rogers of the Census Bureau. This completes the report by states: The previous reports were published, as they were given out, in earlier issues of the ELECTRICAL REVIEW.

The actual number of new stations added in North Dakota since 1912 amounted to 91, of which 75 were commercial and 16 municipal; but, as the result of a number of combinations and other changes, a net increase of only 85 establishments is shown.

CENTRAL-STATION STATISTICS FOR NORTH DAKOTA.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	Per cent of increase.[1] 1912 to 1917
Number of establishments	127	42	29	.....	.....
Commercial	101	33	21	.....	.....
Municipal	26	9	8	.....	.....
Income	$2,003,826	$873,111	$533,383	275.7	129.5
Electric service	$1,712,441	$835,504	$480,042	256.7	105.0
All other	$291,385	$37,607	$53,341	446.3	674.8
Total expenses, including salaries and wages	$1,647,691	$714,294	$413,506	298.5	130.7
Number of persons employed	419	232	150	179.3	80.6
Salaries and wages	$343,741	$197,983	$113,383	203.2	73.6
Total hp.	29,079	16,169	10,277	183.0	79.8
Steam engines:					
Number	117	74	58	.....	.....
Hp.	24,679	15,851	9,972	147.5	55.7
Internal-combustion engines:					
Number	157	8	2	.....	.....
Hp.	4,400	318	205	2046.3	1283.6
Water wheels:					
Number	.....	.....	1	.....	.....
Hp.	.....	.....	100	.....	.....
Kw. capacity of dynamos	20,041	10,824	5,819	244.4	85.2
Output of stations, kw-hr.	22,978,006	12,298,553	8,229,765	179.2	86.8
Stationary motors served:					
Number	2,281	1,145	327	597.6	99.2
Hp.	11,102	6,128	1,816	511.3	81.2
Number of street lamps:					
Arc	497	644	[2]	.....	—22.8
Incandescent, etc.	11,028	5,074	[2]	.....	117.3

[1]A minus sign (—) denotes decrease; percentages omitted where base is less than 100. [2]Not available.

Steam supplied 52.8% of the total horsepower in Minnesota at the census of 1917, but in 1912 and in 1907 water power contributed more than half the totals—54.1% and 58.8%, respectively.

CENTRAL-STATION STATISTICS FOR MINNESOTA.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	Per cent of increase.[1] 1912 to 1917.
Number of establishments	255	195	171	49.1	30.8
Commercial	123	91	79	.....	.....
Municipal	132	104	92	.....	.....
Income[2]	$12,968,715	$6,937,841	$3,478,009	272.9	86.9
Electric service	$12,080,171	$6,647,199	$3,333,469	262.3	81.7
All other	$888,544	$290,642	$144,540	514.7	205.7
Total expenses, including salaries and wages	$11,191,974	$5,580,525	$2,986,277	274.8	100.6
Number of persons employed	2,520	1,568	1,062	137.3	60.7
Salaries and wages	$2,011,145	$1,222,493	$755,778	166.1	64.5
Total hp.	225,541	148,111	121,825	85.1	52.3
Steam engines:					
Number	250	247	250	.....	1.2
Hp.	119,001	63,184	48,741	144.1	88.3
Internal-combustion engines:					
Number	148	54	22	.....	.....
Hp.	8,092	4,755	1,428	466.7	70.2
Water wheels:					
Number	88	76	71	.....	.....
Hp.	98,448	80,172	71,656	37.4	22.8
Kw. capacity of dynamos	162,854	93,502	78,516	107.4	74.2
Output of stations, kw-hr.	440,932,508	186,045,055	87,579,431	403.5	137.0
Stationary motors served:					
Number	20,915	12,203	3,711	463.6	71.4
Hp.	282,784	75,973	41,095	588.1	272.2
Number of street lamps:					
Arc	5,565	6,495	[3]	.....	—14.3
Incandescent, etc.	48,223	21,776	[3]	.....	121.4

[1]A minus sign (—) denotes decrease; percentages are omitted where base is less than 100. [2]Exclusive of $1,831 in 1917 and $123,234 in 1912, reported by street and electric railway companies as income from sale of electric current. [3]Not available.

Large increases are shown by the Alabama central stations in substantially all items for both five-year periods covered by the table, but the increases from 1912 to 1917 are both absolutely and relatively very much greater than those for the preceding five years.

CENTRAL STATION STATISTICS FOR ALABAMA.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	Per cent of increase.[1] 1912 to 1917.
Number of establishments	882	69	55	.....	.....
Commercial	37	34	27	.....	.....
Municipal	45	35	28	.....	.....
Income[2]	$3,152,709	$1,257,720	$1,012,743	211.3	150.7
Electric service	$3,018,778	$1,234,540	$997,506	202.6	144.5
All other	$133,931	$23,180	$15,237	799.0	477.8
Total expenses, including salaries and wages	$2,895,713	$980,169	$872,302	232.0	195.4
Number of persons employed	806	456	343	135.0	76.8
Salaries and wages	$602,050	$286,936	$208,533	188.7	109.8
Total hp.	182,793	34,473	26,404	592.3	430.2
Steam engines:					
Number	120	94	84	.....	.....
Hp.	79,232	24,574	19,377	308.9	222.4
Internal-combustion engines:					
Number	8	2	1	.....	.....
Hp.	705	19	20	.....	.....
Water wheels:					
Number	18	15	15	.....	.....
Hp.	102,856	9,880	7,007	1367.9	941.0
Kw. capacity of dynamos	128,509	24,477	17,124	650.5	425.0
Output of stations, kw-hr.	330,771,965	48,602,553	30,846,764	972.3	580.6
Stationary motors served:					
Number	1,583	1,065	541	192.6	48.6
Hp.	17,363	11,148	5,650	207.3	55.7
Number of street lamps:					
Arc	1,702	2,314	[3]	.....	—26.4
Incandescent, etc.	7,212	2,805	[3]	.....	157.1

[1]A minus sign (—) denotes decrease; percentages not shown where base is less than 100. [2]Exclusive of $1,402,496 in 1917 and $1,017,134 in 1912, reported by street and electric railway companies as income from sale of electric current. [3]Not available.

Aside from the natural increase in the output of current by the Pennsylvania central stations, much of the gain between 1912 and 1917 may be attributed to the large sale of current for power and mechanical purposes at a low rate, and to the fact that a number of electric-railway companies that generated current in 1912 purchased it in 1917.

CENTRAL-STATION STATISTIC FOR PENNSYLVANIA.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	Per cent of increase.[1] 1912 to 1917.
Number of establishments	284	284	327	—13.2	.....
Commercial	232	239	282	—17.7	—2.9
Municipal	52	45	45	.....	.....
Income[2]	$52,259,350	$24,387,863	$16,015,392	226.3	114.3
Electric service	$49,677,404	$23,482,208	$15,400,800	222.6	111.6
All other	$2,581,946	$905,655	$614,592	320.1	185.1
Total expenses, including salaries and wages	$42,899,262	$18,174,684	$12,155,341	252.9	136.0
Number of persons employed	10,735	7,300	4,502	138.4	47.0
Salaries and wages	$9,598,492	$5,098,265	$3,241,421	196.1	88.3
Total hp.	1,290,190	615,994	302,537	326.4	109.4
Steam engines:					
Number	529	615	768	—31.1	—14.0
Hp.	1,104,086	465,968	264,205	317.9	136.9
Internal-combustion engines:					
Number	85	84	66	.....	.....
Hp.	19,496	17,733	7,469	161.0	9.9
Water wheels:					
Number	133	136	119	11.8	—2.2
Hp.	166,608	132,293	30,863	439.8	25.9
Kw. capacity of dynamos	910,434	427,304	212,543	328.4	113.1
Output of stations, kw-hr.	3,049,493,792	989,665,167	416,554,167	632.1	208.1
Stationary motors served:					
Number	64,227	29,119	10,063	538.2	120.6
Hp.	1,139,935	333,414	122,461	830.8	241.9
Number of street lamps:					
Arc	43,521	45,596	[3]	.....	—4.6
Incandescent, etc.	114,706	28,630	[3]	.....	300.6

[1]A minus sign (—) denotes decrease; percentages are omitted where base is less than 100. [2]Exclusive of $1,031,954 in 1917 and $708,458 in 1912, reported by street and electric railway companies as income from sale of electric current. [3]Not available.

The number of new stations added in Michigan since 1912 was 59, of which 42 were commercial and 17 municipal; but, as the result of a number of com-

binations and other changes, a net increase of only 6 establishments, of which 5 were commercial, is shown.

CENTRAL-STATION STATISTICS FOR MICHIGAN.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	1912 to 1917.
Number of establishments	241	235	234	3.0	2.6
Commercial	132	127	130	1.5	3.9
Municipal	109	108	104	4.8	0.9
Income[2]	$24,095,328	$11,518,256	$6,072,010	296.8	109.2
Electric service	$23,560,198	$11,127,031	$5,750,447	309.7	111.7
All other	$535,130	$391,225	$321,563	66.4	36.8
Total expenses, including salaries and wages	$19,216,138	$9,784,138	$4,611,070	316.7	96.4
Number of persons employed	4,738	3,876	1,780	166.2	22.2
Salaries and wages	$5,223,067	$2,843,371	$1,126,813	363.5	83.7
Total hp.	612,632	377,182	184,207	232.6	62.4
Steam engines:					
Number	272	319	323	—15.8	—14.7
Hp.	411,603	250,477	97,866	320.6	64.3
Internal-combustion engines:					
Number	76	27	11	.....	.....
Hp.	3,014	1,626	603	399.8	85.4
Water wheels:					
Number	312	245	249	25.3	27.3
Hp.	198,015	125,079	85,738	131.0	58.3
Kw. capacity of dynamos	450,716	247,789	101,714	343.1	81.9
Output of stations, kw-hr.	1,504,239,843	525,615,508	208,154,199	622.6	186.2
Stationary motors served:					
Number	37,799	18,400	7,089	433.2	105.4
Hp.	348,811	174,009	53,245	555.1	100.4
Number of street lamps:					
Arc	18,102	16,220	[3]	.....	11.6
Incandescent, etc.	41,365	22,425	[3]	.....	84.4

[1]A minus sign (—) denotes decrease; percentages omitted where base is less than 100. [2]Exclusive of $326,581 in 1917 and $426,444 in 1912, reported by street and electric railway companies as income from sale of electric current. [3]Not available.

Increases are shown in nearly all important items for both five-year periods covered by the report for Idaho but the increases from 1907 to 1912 were in most cases both absolutely and relatively greater than those for the preceding five years. This condition is due to the fact that since the census of 1912 extensive combinations have been made in the electric systems of the states of Idaho and Utah, as a result of which a small increase in Idaho during the five-year period 1912-17 is accompanied by a very great increase in Utah. Considering the two states as a whole, the differences between the rates of increase for 1907-12 and for 1912-17 would be much less pronounced than is the case for either state alone.

CENTRAL-STATION STATISTICS FOR IDAHO.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	1912 to 1917.
Number of establishments	46	38	42	.....	.....
Commercial	38	35	40	.....	.....
Municipal	8	3	2	.....	.....
Income	$2,368,619	$1,615,940	$719,395	229.2	46.6
Electric service	$2,202,356	$1,580,082	$692,489	218 0	39.4
All other	$ 166,263	$ 35,858	$ 26,906	517.9	363.7
Total expenses, including salaries and wages	$1,947,657	$1,537,260	$475,818	309.3	26.7
Number of persons employed	469	324	188	149.5	44.8
Salaries and wages	$ 450,753	$ 334,063	$171,125	163.4	34.9
Total hp.	56,422	56,375	13,694	312.0	0.1
Steam engines:					
Number	10	14	19	.....	.....
Hp.	2,650	4,525	2,202	20.3	—41.4
Internal-combustion engines:					
Number	4	.....	.....	.....	.....
Hp.	148	.....	.....	.....	.....
Water wheels:					
Number	71	63	37	.....	.....
Hp.	53,624	51,850	11,492	366.6	3.4
Kilowatt capacity of dynamos	37,103	35,656	7,082	423.9	4.1
Output of stations, kw-hr.	145,307,596	115,812,292	9,577,588	1417.2	25.5
Stationary motors served:					
Number	867	1,723	406	113 5	—49.7
Hp.	12,668	27,142	4,054	212.5	—53.3
Number of street lamps:					
Arc	924	1,109	[2]	.....	—16.7
Incandescent, etc.	6,863	3,886	[2]	.....	76.6

[1]A minus sign (—) denotes decrease; percentage not shown where base is less than 100. [2]Not available.

In Missouri steam supplied the greater part of the primary power at each of the three census for which figures are given, but the increase in the use of water power between 1912 and 1917 was so rapid that the proportion contributed by steam fell during the five-year period from 97.6 to 88.5%.

CENTRAL-STATION STATISTICS FOR MISSOURI.

	1917.	1912.	1907.	Per cent of increase. 1907 to 1917.	1912 to 1917.
Number of establishments	293	190	162	80.9	54.2
Commercial	206	125	104	98.1	64.8
Municipal	87	65	58	.....	.....
Income[2]	$14,434,506	$9,746,600	$5,805,828	148.6	48.1
Electric service	$13,974,980	$9,299,495	$5,683,795	145.9	50.3
All other	$ 459,526	$ 447,105	$ 122,033	276.6	2.8
Total expenses, including salaries and wages	$12,790,796	$7,484,853	$5,341,126	139.5	70.9
Number of persons employed	3,766	2,434	1,800	109.2	54.7
Salaries and wages	$ 2,776,597	$1,883,844	$1,306,640	112.5	47.4
Total hp.	226,030	182,095	111,416	102.9	24.1
Steam engines:					
Number	309	301	362	—14.6	2.6
Hp.	199,950	177,721	108,451	84.4	12.5
Internal-combustion engines:					
Number	177	22	13	.....	.....
Hp.	7,415	2,472	963	670.0	200.0
Water wheels:					
Number	12	5	5	.....	.....
Hp	18,665	1,902	2,002	832.3	881.3
Kilowatt capacity of dynamos	166,813	122,786	68,467	143.6	35.8
Output of stations, kw-hr.	266,431,159	232,828,763	147,328,446	80.8	14.4
Stationary motors served:					
Number	10,710	15,429	8,923	20.0	—30.6
Hp.	174,861	116,971	54,111	223.2	49.5
Number of street lamps:					
Arc	4,410	6,687	[3]	.....	—34.1
Incandescent, etc.	30,079	16,719	[3]	.....	79.9

[1]A minus sign (—) denotes decrease; percentages omitted where base is less than 100. [2]Exclusive of $1,665,408 in 1917 and $551,422 in 1912, reported by street and electric railway companies as income from sale of electric current. [3]Not available.

The actual number of new stations added in Texas since 1912 was 62, of which 58 were commercial and 4 municipal; but, as the result of a number of combinations in the commercial systems and other changes, a net increase of only one establishment is shown.

CENTRAL-STATION STATISTICS FOR TEXAS.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	1912 to 1917.
Number of establishments	254	253	218	16.5	0.4
Commercial	230	235	209	10.0	—2.1
Municipal	24	18	9	.....	.....
Income[2]	$10,232,709	$6,783,972	$3,792,203	169.8	50.8
Electric service	$10,000,025	$6,654,616	$3,668,722	172.6	50.3
All other	$ 232,684	$ 129,356	$ 123,481	88.4	79.9
Total expenses, including salaries and wages	$ 8,211,360	$4,924,093	$3,096,436	165.2	66.8
Number of persons employed	2,531	2,021	1,275	98.5	25.2
Salaries and wages	$ 1,968,423	$1,348,966	$ 789,219	149.4	45.9
Total hp.	184,829	126,616	71,914	157.0	46.0
Steam engines:					
Number	311	385	339	—8.3	—19.2
Hp.	156,762	113,611	66,094	137.2	38.0
Internal-combustion engines:					
Number	214	99	53	.....	.....
Hp.	24,714	9,502	3,058	708.2	160.1
Water wheels:					
Number	26	18	23	.....	.....
Hp.	3,353	3,503	2,762	21.4	—4.3
Kilowatt capacity of dynamos	133,917	84,564	48,558	175.8	58.4
Output of station, kw-hr.	317,581,985	149,008,819	75,829,108	318.8	113.1
Stationary motors served:					
Number	15,334	8,445	4,223	263.1	81.6
Hp.	163,477	50,869	18,634	777.3	221.4
Number of street lamps:					
Arc	5,569	5,504	[3]	.....	1.2
Incandescent, etc.	20,981	9,567	[3]	.....	119.3

[1]A minus sign (—) denotes decrease; percentages are omitted where base is less than 100. [2]Exclusive of $1,967,667 in 1917 and $568,641 in 1912, reported by street and electric railway companies as income from sale of electric current. [3]Not available.

Large increases are shown by the Wisconsin central stations in substantially all items for both five-year periods covered by the table, but the increases from 1912 to 1917 are, in most cases, greater in absolute amount, although smaller as measured by percentages, than those for the preceding five years.

CENTRAL-STATION STATISTICS FOR WISCONSIN.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	1912 to 1917.
Number of establishments	269	251	206	30.6	7.2
Commercial	171	173	142	20.4	—1.2
Municipal	98	78	64	.....	.....
Income[2]	$11,923,367	$6,274,589	$2,278,637	423.3	90.0
Electric service	$11,594,068	$5,955,194	$2,127,080	445.1	94.7
All other	$ 329,299	$ 319,395	$ 151,557	117.3	3.1
Total expenses, including salaries and wages	$ 9,715,528	$5,321,258	$1,969,142	393.4	82.6
Number of persons employed	2,719	1,921	867	213.6	41.5
Salaries and wages	$ 2,475,971	$1,227,013	$ 541,049	357.6	101.8
Total hp.	368,211	145,411	58,889	525.3	153.2
Steam engines:					
Number	262	272	247	6.1	—3.7
Hp.	219,534	72,145	37,809	480.6	204.3
Internal-combustion engines:					
Number	92	46	22	.....	.....
Hp.	4,622	4,500	2,079	122.3	2.7
Water wheels:					
Number	231	176	140	65.0	31.2
Hp.	144,055	68,766	19,001	658.1	109.5
Kilowatt capacity of dynamos	252,646	98,839	40,711	520.6	155.6
Output of station, kw-hr.	517,539,925	215,402,974	52,546,210	884.9	140.3
Stationary motors served:					
Number	10,428	6,699	2,366	340.7	55.7
Hp.	87,230	72,525	17,995	384.7	20.3
Number of street lamps:					
Arc	7,305	9,187	[3]	.....	—20.5
Incandescent, etc.	25,783	10,888	[3]	.....	136.8

[1]A minus sign (—) denotes decrease; percentages are omitted where base is less than 100. [2]Exclusive of $892,146 in 1917 and $613,694 in 1912, reported by street and electric railway companies as income from sale of electric current. [3]Not available.

Although steam supplied the greater part of the primary power at each of the three censuses for South Dakota, for which figures are given, there was a pronounced increase in the amount of power derived from internal-combustion engines.

CENTRAL-STATION STATISTICS FOR SOUTH DAKOTA.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	1912 to 1917.
Number of establishments	130	77	37	.....	.....
Commercial	95	64	29	.....	.....
Municipal	35	13	8	.....	.....
Income[2]	$2,050,067	$1,162,522	$513,682	299.1	76.3
Electric service	$1,885,697	$1,095,922	$492,767	282.7	72.1
All other	$164,370	$66,600	$20,915	685.9	146.8
Total expenses, including salaries and wages	$1,733,635	$965,763	$433,841	299.6	79.5
Number of persons employed	446	338	169	163.9	32.0
Salaries and wages	$408,670	$264,159	$127,143	221.4	54.7
Total hp.	32,176	27,748	12,984	147.8	16.0
Steam engines:					
Number	55	50	52	.....	.....
Hp.	15,800	16,003	10,251	54.1	—1.3
Internal-combustion engines:					
Number	178	86	10	.....	.....
Hp.	10,006	4,832	528	1795.1	107.1
Water wheels:					
Number	11	15	12	.....	.....
Hp.	6,370	6,913	2,205	188.9	—7.9
Kw. capacity of dynamos	24,248	20,032	10,046	141.4	21.0
Output of stations, kw-hr.	31,810,487	24,703,754	13,615,015	133.6	28.8
Stationary motors served:					
Number	3,143	1,394	279	1026.5	125.5
Hp.	19,673	13,619	3,649	439.1	44.4
Number of street lamps:					
Arc	386	904	[3]	.....	—57.3
Incandescent, etc.	7,558	4,382	[3]	.....	72.5

[1]A minus sign (—) denotes decrease; percentages omitted where base is less than 100. [2]Exclusive of $49 in 1917, reported by street and electric railway companies as income from sale of electric current. [3]Not available.

COMBINED CENTRAL-STATION REPORT FOR UNITED STATES.

Census Bureau's Summary of State Reports Shows Decided Increases in Industry Throughout Country.

According to a report about to be issued by Director Sam L. Rogers, of the Bureau of the Census, Department of Commerce, the electric light and power stations in the United States during the year 1917 generated more than 25 billion kw-hr. of electric energy, producing an income of more than a half billion dollars, and gave employment to more than 100,000 persons, whose salaries and wages aggregated nearly $100,000,000. The output in 1917 was more than double that for 1912 and more than quadruple the output for 1907.

This report which summarizes the individual state reports that have been published in previous issues of the ELECTRICAL REVIEW, was prepared under the supervision of Eugene F. Hartley, chief statistician for manufacturers and covers both commercial and municipal plants, but does not cover electric plants operated by factories, hotels, etc., which generate current for their own consumption; plants operated by the Federal Government and state institutions; nor plants that were idle or in course of construction.

The figures show great strides in the industry during both of the five-year periods 1907-12 and 1912-17. The output of electric energy by the light and power stations increased at a considerably greater rate, and their expenses at a slightly greater rate, than their income; and the rate of increase in the number of persons employed was much smaller, particularly during the later five-year period, than that in the amount of business done. The total number of establishments increased from 5221 in 1912 to 6541 in 1917, the latter comprising 4224 commercial and 2317 municipal establishments. The increase indicated by these figures is somewhat misleading, since 2296 new establishments came into existence between 1912 and 1917, but as a result of combinations and other changes, the net increase was only 1320, comprising 565 commercial and 755 municipal stations.

The total income of the stations in 1917, of which 95.3% represented electric service, amounted to $526,886,408, an increase of 74.3% as compared with 1912 and of 200% as compared with 1907. The total expenses were $427,136,049, or 82.1% more than in 1912 and 218.3% more than in 1907. The employees of the light and power stations numbered 105,546, an increase of 33% over 1912 and of 121.6% over 1907; and their salaries and wages aggregated $95,239,954, an increase of 55.7% as compared with 1912 and of 168.9% over 1907.

CENTRAL-STATION STATISTICS FOR UNITED STATES.

	1917.	1912.	1907.	Per cent of increase.[1] 1907 to 1917.	1912 to 1917.
Number of establishments	6,541	5,221	4,714	38.8	25.3
Commercial	4,224	3,659	3,462	22.0	15.4
Municipal	2,317	1,562	1,252	85.1	49.3
Income	$526,886,408	$302,273,398	$175,642,338	200.0	74.3
Electric service	$502,100,346	$287,138,657	$169,614,691	196.0	74.9
All other	$ 24,786,062	$ 15,134,741	$ 6,027,647	311.2	63.8
Total expenses, including salaries and wages	$427,136,049	$234,577,277	$134,196,911	218.3	82.1
Number of persons employed	105,546	79,335	47,632	121.6	33.0
Salaries and wages	$ 95,239,954	$ 61,161,941	$ 35,420,324	168.9	55.7
Total hp.	12,837,998	7,530,044	4,098,188	213.7	70.8
Steam engines:					
Number	7,464	7,847	8,054	—7.3	—4.9
Hp.	8,389,389	4,949,778	2,693,273	211.5	69.5
Internal-combustion engines:					
Number	2,946	1,116	463	536.3	164.0
Hp.	217,186	111,035	55,828	289.0	95.6
Water wheels:					
Number	3,357	2,939	2,481	35.3	14.2
Hp.	4,251,423	2,469,231	1,349,087	215.1	72.2
Kw. capacity of dynamos	9,001,872	5,165,439	2,709,225	232.2	74.3
Output of stations, kw-hr.	25,438,611,417	11,569,109,885	5,862,276,737	333.9	119.9
Stationary motors served:					
Number	554,817	435,473	167,184	231.9	27.4
Hp.	9,216,323	4,130,619	1,649,026	458.9	123.1
Number of street lamps:					
Arc	256,838	348,643	[2]	.....	—26.3
Incandescent, etc.	1,389,382	681,957	[2]	.....	103.7

[1]A minus sign (—) denotes decrease. [2]Not available.

Editorial Comment

The Business Situation

ANYONE could have predicted 6 months or a year ago almost the exact conditions that exist today. We have all had fair warning of the present "period of reconstruction." It is utterly impossible to change from a strenuous war program to a peace basis in a few weeks or even in a few months. Just as it took months to develop our industrial war machine so will it take months to get back to a pre-war basis but a great deal can be done to shorten the period of uncertainty if we all do our share.

Much of the uncertainty today, much of the hesitancy that is holding up necessary work is a condition of the mind and what is most needed is unadulterated optimism.

Applying Vector Analysis in Design

VECTOR analysis has long been taught students of alternating-current phenomena who have employed it in working out classroom or examination problems and then proceeded to forget all about it. It has been applied in the solution of new theoretical relations to a considerable extent.

In this issue we publish the last part of an article by Mr. Millard C. Spencer on the design of radio transmitters. Aside from this subject becoming of increasing interest due to the rapid developments in radio work, the author presents a splendid example of the practical application of vector analysis for predetermining and checking various features of design. There seems to be ample opportunity for using the vector diagram in simplifying the design of other apparatus and thus save much of the time and tedious labor involved in the cut-and-try method.

Relieving War-Time Utility Rates

FEAR on the part of the public that the increased rates for utility service made necessary by war-time prices for fuel, labor and other essentials would become permanent is being dispelled by recent orders of some state public service commissions that had granted the rate increases only during the war emergency. A case in point is the order of the Board of Public Utility Commissioners of New Jersey which had permitted street-car fares to be raised to 7 cents up to April 1, 1919. The Commission has just denied further extension of this time limit and, holding that the emergency is passing, has ordered a 6-cent fare to be put into effect. This shows that the interests of the public are being looked after and anxiety on this matter is entirely groundless.

Central-Station New Business

RESUMPTION of sales activities by central-station companies is an encouraging sign of the times. Spring house-wiring campaigns are already in progress in many communities and in a considerable number of companies power-sales work is also being resumed.

The "Electrify Your Home" campaign of the Society for Electrical Development is a most timely effort that should be of the greatest value in putting the electrical industry back on a pre-war basis. It deserves hearty support by the entire industry.

Electrical Development in England

SEVERAL branches of the electrical industry in England have joined in the formation of the Electrical Development Association, whose aims, scope and work, as reported on another page in this issue, are planned to be very similar to those of our own well-established and useful Society for Electrical Development. The restrictions of the war having been removed, our British friends see that active stimulation of electrical business is necessary in order to load up supply systems, fill manufacturing plants with orders and find renewed installation work.

Thus the principle of co-operation and co-ordination of effort in the electrical industry is receiving international recognition, which should encourage those of our friends that have for these many years done so much to make the various electrical interests pull together for everything electrical and to teach the public to "Do It Electrically."

Science Shortening Hours of Work

IN AN interview in London a few days ago the well-known wireless wizard Marconi is reported as saying that he looked forward to scientific developments continuing to relieve the burden of work so that we may in the future be able to accomplish a day's work in three hours and therefore have much more time available for culture and recreation.

While few of us may be ready to predict so short a working day, the tendency is undoubtedly in this direction. Only a few generations ago 12 to 14 hours was not an uncommon day's work. We are leaving the 10-hour day and in but a short time 8 hours will be practically universal. Science and invention have done more to make this possible than agitation. Electricity is doing its share to relieve drudgery. In some places 6 hours is proposed as the working day. But a sudden drop to 6 hours cannot be advocated by thoughtful persons as a sensible measure just now.

A Department-Store Electric Baking Installation

THE electric baking installation described elsewhere in this issue possesses a number of interesting features. From the engineering aspect the installation is pretty much like other installations. However, there is another important aspect, namely, the publicity aspect.

The department store where the three electric ovens are installed, in full view of the clientele, is one of Chicago's leading stores. The patronage—the people coming and going through the store during a year—reaches into the millions, and a considerable percentage of these will be brought into contact to some extent with the bakery where things are done electrically and a large output is turned out wholesomely in a relatively small area.

The electric ovens have received considerable publicity through the medium of the daily papers. The department store has featured the installation in a popular way, discussing the installation from the sanitary and culinary aspects. These advertisements have been illustrated with various forms of cakes and good things to eat that are baked electrically. The ovens and their products have attracted the attention of the public, and a large increase in the sale of confectionery and bakery goods has resulted.

There is one matter that the central stations can well afford to bear in mind in connection with the supply of service to local installations of special interest. Capitalize the local interest to further the interests of electric service. If attention and favorable comment can be obtained about the bakery goods from a large electric oven, make the most of it. If a large and famed restaurant, cafeteria or club cooks electrically, tell people about it, both the patrons and the public *en masse*. Make the most of it.

Once before in an editorial we said that large-scale electric cooking would help the smaller class of residence and home cooking. While this statement referred more specifically to those territories lacking a cooking rate, the statement is true insofar as the advertising feature of the large installation surpasses the small installation. The advertising carried on by Rothschild & Co. and the publicity they receive through personal contact patronage, their employes and their customers cannot fail to create greater interest and probably give a very real impetus to electric cooking and baking in Chicago.

The load comprised by the Rothschild installation has a satisfactory load-factor, considerably higher than that of any residence; likewise, the monthly energy consumption of this one installation is in excess of a good many average residences. Whether viewed as a revenue producer, as a load builder or as an advertising medium, the large-scale electric cooking and baking installation is worth going after and well worth advertising once it is in service.

Publicity to Meet Attacks on Utility Regulating Commissions

REGULATION of public utilities by state commissions has made rapid strides in the last dozen years in nearly all sections of the country. Careful students of the relations between the public and the public utility companies realize that regulation by the commissions which have been set up in nearly all the states is a vast improvement on the inconsistent, unsystematic, haphazard and in many cases inequitable control of public utilities formerly exercised by various municipalities. The steady growth of regulation by commissions, provided with nonpartisan staffs of engineers, inspectors and accountants to make expert studies of the utility and of its service before orders affecting it are issued, has been due chiefly to the fairness and wisdom of this system of control, which has generally been acknowledged even by the staunch advocates of so-called "home rule" of utilities.

Another factor contributing to the growing popularity of this newer method of control has been the fairly steady decrease in cost of most utility service for a long period of years prior to our becoming involved in the war, this decrease in cost being generally made more uniform for various classes of utility patrons and in many instances accelerated by the action of the commissions. In fact, the public has in large measure come to look upon the commissions as mediums established primarily for securing lower rates.

Last year, however, the rapidly mounting costs of labor, fuel and other operating charges offset special war-time economies and compelled a large number of utilities to seek higher rates as the only means for escaping financial disaster or serious deterioration of service. President Wilson and then Secretary of the Treasury McAdoo urged prompt consideration of the utilities' requests so that their rendering of highly valuable war service be not impaired. The commissions gave careful consideration to the petitions and in many instances granted the relief sought through higher rates usually limited for the period of the war or the continuance of the abnormally high level of operating costs.

While usually these increased rates were cheerfully accepted by the public, in some few cases they aroused opposition, often stimulated by local politicians, and the popularity of commission control began to waver. The primary reason back of this developing coolness toward the commissions in some states was the failure of the public to grasp the full significance of commission regulation and this in turn was due largely to the fact that its principles were seldom explained to the public. Evidently, greater publicity of the aims and powers of the commissions, how they conducted their work and what they had accomplished would have shown that the commissions were obligated

to raise rates when necessary as well as to lower them when possible.

A typical case of attacks on commission control due to these various related causes is being witnessed in Illinois, in the Legislature of which there are now pending several bills nearly all of which aim to curtail or even to abolish the jurisdiction of the State Public Utilities Commission. The "home rule" agitation was revived in several cities, largely as a well-tried and apparently popular political campaign bait in the municipal elections held this week. In Chicago, for instance, each of the candidates for mayor had a "home rule" plank in his platform and freely discussed gas and traction utility questions that were clearly in the province of the State Utilities Commission to investigate and settle. What had been and was being done on these matters by the Commission was not widely known among the citizens, although their interests were being carefully safeguarded by that body. The need for more widespread publicity, dignified and clarifying, became quite apparent.

Before a meeting of engineers on last Monday, Mr. B. H. Peck, electrical engineer of the Commission, presented some very interesting facts on how the Commission works and what it has been able to accomplish in the first four years of its existence in spite of many handicaps during this initial period. As reported elsewhere in this issue, the Commission has effected savings to utility customers through rate reductions amounting to nearly $6,000,000 and this total was not materially affected by the relatively few increases granted last year. These and other important facts about the Commission should be made better known to the citizens of the state as well as their representatives in the Legislature. The annual and special reports of the Commission of course are available, but the public has little time to dig into voluminous reports for simple statements of what is being done by the Commission. With more general knowledge of its work we shall see less attacks upon the Commission and less likelihood of utility questions being thrown back into the arena of city politics to furnish convenient issues for vote-seeking candidates for office.

Telegraph Rates and Car Fares

POSTMASTER-GENERAL BURLESON has ordered a 20% increase in telegraph rates on all telegrams with the exception of practically only newspaper dispatches. The reason for the increase is to provide more revenue to meet higher wages of telegraphers and other increased operating expenses since the Government took over the lines. Obviously, the rate increases are absolutely necessary to prevent the telegraph system going into bankruptcy while in the Government's hands. In this way the history of the Railroad Administration is being repeated. Government operation is producing certain economies that are much more than offset by the higher labor costs. The public has nothing to say in the matter, however; all it can do is to accept Mr. Burleson's candid explanation and pay the higher rates as cheerfully as possible. It is estimated that about $16,000,000 will be added to the country's telegraph tolls annually by this simple order, which was issued without holding hearings where the interests of the telegraph users could be presented, in striking contrast to the procedure of the state public service commissions.

How different is the situation with respect to another class of utility service! Nearly all our street-railway companies have had similar increased operating expenses to meet; but has it been as easy to pass on part of the burden to their patrons? Many companies, it is true, have received more or less temporary relief where fair-minded utility commissions could be appealed to. But a great number are still on the verge of financial disaster because in many states the commissions are without power to change franchise rates and the public will not cheerfully submit to higher fares as long as there is hope of balking the utility corporations. Increased rates are no less urgent whether Uncle Sam operates the utilities or the companies continue to do so. Cannot this fact be brought to the public's notice?

Foreign Investments to Increase Exports

AT A RECENT meeting in London, a banker in discussing British post and pre-war trade emphasized the importance of financing foreign enterprises and the extent to which such financing enables the companies to increase their home exports. Few people realize, perhaps, the extent to which British-owned companies in foreign lands are responsible for her large export trade. Speaking further, this speaker said:

"Finance and industry should go hand in hand, and manufacturers should so strengthen themselves, as they are doing, that they can bear their part in these over-sea contracts. I am glad to see combinations among manufacturers resulting in the ability to supply complete installations of electric enterprises. If this were followed up by the formation of a company to take the securities resulting from such new projects—just as the General Electric Co. of America (which has a capital of over $100,000,000) formed the Electric Bond & Share Co., having a capital of over $15,000,000—a further advance would be made in the direction of practical results. The British Trade Corporation will doubtless fill a useful role in this direction. If we fail to continue expanding our over-sea industrial possessions, America will take our place and industry at home will languish."

The above remarks are timely and sound. Vast foreign markets are opening up for development. American capital can hasten such developments, and in bringing them about create a demand for American-made goods and promote the introduction of American ways. There is work for our men and our factories abroad as well as at home. If our foreign efforts flourish, things will not languish at home.

Week's Events

Wisconsin Electrical Convention Held—Illinois Utilities Commission Endorsed—Electrical Safety Conference Formed

PRELIMINARY PROGRAM FOR NATIONAL CONVENTION OF ELECTRICAL CONTRACTORS.

Important Topics to Be Discussed at Milwaukee Meeting July 16-18—Outing at Waukesha Beach.

Preliminary arrangements for the coming annual convention of the National Association of Electrical Contractors and Dealers have been completed, and are being announced by W. H. Morton, general manager. The convention will be held in Milwaukee, Wis., and the Executive Committee of the National Association will meet in that city on July 14 and 15, while the convention meetings will be July 16, 17 and 18.

The headquarters of the association will be at the Hotel Pfister, and meetings of the Executive Committee will be held at this hotel. The general meeting of the convention will be at the Auditorium in Milwaukee, excepting on Thursday, when the meeting will be at Waukesha Beach, a pleasant summer resort 18 miles from Milwaukee.

The tentative program of the convention is as follows, but, of course, may be subject to some modifications:

July 14—Meeting of the National Excutive Committee at the Hotel Pfister at 10 a. m. and 2 p. m. Registration bureau for the convention opens at Hotel Pfister at 4 p. m. on this day, and will be open for the rest of the week.

July 15—Meeting of National Executive Committee at Hotel Pfister at 10 a. m. and 2 p. m.

July 16—Convention opens at the Auditorium at 10 a. m. The opening address will be delivered by a representative of the Wisconsin State Association and an address of welcome by the governor of the State. Response will be made by the chairman of the National Association, W. Creighton Peet, of New York City. This will be followed by an address on co-operation, speaker to be selected.

Meeting at 2 p. m.—Lecture on the standard cost accounting system, illustrated by lantern slides. Address on estimating methods, also illustrated by lantern slides.

At 9 p. m. of this day the annual reception and dance will be held at the Hotel Pfister, in the large ball room on top floor.

July 17—All those attending the convention will be taken by special cars to Waukesha Beach and a regular session of the convention will be held at 10:30 a. m. at which there will be an address by W. L. Goodwin, also an address on the general business conditions by a speaker to be selected.

Luncheon will be served at Waukesha Beach, and the afternoon devoted to athletic and aquatic sports.

July 18—Morning session at the Auditorium in Milwaukee; at this session the organization will be divided into sections, one discussing merchandising and fixture dealings, one discussing the handling of machinery repairs; one being a meeting of state and local secretaries for the purpose of discussing Association work.

Afternoon session at 2 p. m. in the Auditorium, which will be devoted to such matters as may be referred to the session by the Executive Committee.

At 6:30 p. m. on this day the annual dinner of the association will be given at the Hotel Pfister.

All of the indications point to this being the most successful convention that the organization has ever held, and the officers expect an extremely large attendance.

WISCONSIN CENTRAL-STATION MEN HOLD ANNUAL CONVENTION.

Many Interesting Papers Presented and Important Topics Discussed at Milwaukee Meeting.

The Wisconsin Electrical Association held its annual convention at the Hotel Pfister, Milwaukee, March 26 and 27. As was stated in the announcement, this meeting was held in conjunction with the Wisconsin Gas Association—the first day, Tuesday, being devoted to affairs of the latter association, Wednesday, to a joint meeting and Thursday to matters entirely electrical. John St. John of the Madison Gas & Electric Co., Madison, Wis., president of both associations, presided during the entire session. Both associations were well represented at the convention at which numerous interesting papers were presented.

One of the papers presented at the joint session was the "Value of the Quality of Service," by John S. Allen, of the Railroad Commission of Wisconsin. In his paper, Mr. Allen brought out very clearly the value of good service to the public by utility companies and explained the influence which the rendering of such service has upon public service commissions and the public. Some time ago the Railroad Commission of Wisconsin formulated a set of "service rules" for public utilities which were drawn up in such a way that the quality of service being rendered could be determined mathematically in a rather satisfactory manner. While strict compliance of these rules is the basis for determining the utility's percentage the result has broadened, since their introduction, in such a way that the actual conformity is determined more and more by the reflection found in the mind of the patron.

Without discounting in any way the importance of good voltage regulation, gas of a uniform b.t.u., etc., therefore, the quality of the service becomes an important factor in the decisions of the Commission. In addition, the quality of service has a very important bearing on the volume of business, the number of complaints and the settlement of these complaints.

The good will of the public toward the utility company is determined by two principal factors; namely, the historical attitude of the company toward the public, that is, the things that it may have done in the past, and the attitude of its present organization toward the

public. The company's attitude is determined by its meter readers, complaint clerks, conductors and motormen, new business solicitors, cashiers, telephone operators and other employes, including the janitors, engineers and truck drivers. The attitude of these employes toward the public is a reflection of the company's attitude.

The attitude of the public toward the company is directly a reflection of the attitude of the company toward the public.

It is a well known principle that an organization reflects the mentality of its head and in no business is this so well exemplified as in that line of business which directly serves the public.

In closing Mr. Allen quoted a modern version of the well-known lines from the Merchant of Venice as exemplifying the value of good service to the public utility.

"The quality of service is not strain'd,
It droppeth as the gentle rain from Heaven
Upon the place beneath; it is twice blest;
It blesseth him that gives, and him that takes;"

Other speakers at this session were Chester Cory, of the Harris Trust & Savings Bank, Chicago, whose subject was "Public Utilities and Securities," and George P. Hambrecht of the Industrial Commission of Wisconsin, who described the work of that commission.

The first paper to be presented to the electrical section was entitled "Public Utilities Rendering Service to Industries" by N. J. Whelan of the Wisconsin-Minnesota Power Co., Eau Claire, Wis. Mr. Whelan described the activities of the industrial department which was put into effect about three years ago by this company. This department devotes its efforts to the gathering of information for industries seeking suitable locations and endeavoring to have them locate in the territory supplied by the company. To date this department has been very successful in its work, several firms of considerable size having been induced to locate in its territory which have added a large load to the company's lines.

An interesting paper on the proper loading of distribution transformers was presented by Frank A. Robbins, electrical engineer of the Superior Water, Light & Power Co., of Superior, Wis. Mr. Robbins' paper is presented substantially in full in another part of this issue.

Following this, A. J. Goedjen, statistician for the Wisconsin Public Service Co., Milwaukee, Wis., presented a comprehensive review of the policies of service extensions as laid down by state commissions. After reviewing a variety of extension rules developed and used by utilities in different sections of the country, Mr. Goedjen stated that in his opinion the Indiana type of rule might well be applied to existing conditions in Wisconsin. This rule adopted by the Public Service Commission of Indiana briefly states that the utility is required to furnish a customer with a free extension when the income for the first year is equal to one-half the direct cost of the extension. When the cost of the extension exceeds this, the utility may require a deposit of the additional cost, this deposit to be refunded as additional consumers are added to the extension, in amounts equaling the cost of the free extension to such customers for a period of ten years. When the utility is doubtful if the prospective business will ever pay a fair return the commission will make special exceptions.

The advantages of this type of ruling are as follows:

1.—That every consumer may have a free extension in proportion to the estimated revenue.

2.—This free extension can be operated by the utility without loss.

3.—The consumer takes the risk in that part of the investment not warranted by revenues at the begininng of the extension.

4.—The utility assumes additional investment in the line if within ten years other consumers are added to the line. This makes the original depositor finally sacrifice only that part of the entire investment in the line which is not warranted by the revenues from the line after ten years of development.

5.—Adjustment in rates or variation in construction costs are automatically included in the calculation.

6.—Utility's capital account will not be likely to be overloaded by unprofitable investments.

Among the other interesting addresses were descriptions of high-tension outdoor substations and switching equipment by Alfred Alsaker of Chicago, Ill., and the new safety cars by H. L. Andrews, of the General Electric Co., Schenectady, N. Y. Dr. Morton G. Lloyd, electrical engineer of the Bureau of Standards, described the revision of the Safety Code now being made. J. B. Sanborn, of Madison, Wis., explained the intent of several bills which are at present before the state legislature and their bearing on public utilities.

During the course of the meeting W. L. Goodwin, author of the "Goodwin Plan" for electrical contractors and dealers, addressed the members as spokesman for the Wisconsin State Association of Electrical Contractors and Dealers, urging their co-operation with that Association. Due to a combination of unfortunate circumstances the value, strength and intentions of the contractor-dealer organization had been misunderstood by the members of the Wisconsin Electrical Association, who had been apparently rebuffed in former attempts at co-operation. After Mr. Goodwin's explanation of the aims of the contractor-dealers' association, however, the members of the Wisconsin Electrical Association appointed a committee to co-operate with the other association which may be expected to solve many of the problems which confront both organizations.

In order to increase the value of the Association to those members who are primarily interested in electric railway operation, a separate section was formed to be composed of these members. This section will have its own officers and will hold separate sessions at the meetings. However, the meetings will be held in conjunction with each other as formerly.

The election of officers resulted in the following being chosen to conduct the affairs of the Association for the coming year: President, Raymond H. Smith, vice-president and manager of the Eastern Wisconsin Electric Co., Sheboygan; first vice-president, W. C. Lounsbury, general superintendent of the Superior Water, Light & Power Co., Superior; second vice-president, A. K. Ellis, general superintendent of the Wisconsin Traction, Light, Heat & Power Co., Appleton; third vice-president, L. R. Boisen, vice-president of the Ashland Light, Power & Street Railway Co., Ashland. J. P. Pulliam of Milwaukee was re-elected to the combined offices of secretary and treasurer.

ELECTRIC CLUB OF CHICAGO ENDORSES UTILITY COMMISSIONS.

The following self-explanatory resolution was adopted at the March 27 meeting of the Electric Club of Chicago:

Whereas, an effort is being made to abolish the Illinois Public Utilities Commission, or to amend the

law so as to limit the jurisdiction of said commission, and

"*Whereas,* the Illinois Public Utilities Commission has demonstrated that the regulation of public utilities is a beneficial state or national governmental function, and

"*Whereas,* the control of privately owned public utilities by local municipal governments has not proved successful generally, and is subject to objectionable and harmful political manipulation;

"Therefore, be it *Resolved,* that the Electric Club of Chicago, in meeting assembled, hereby endorses the fundamental principle of controlling public utilities by a state commission, and hereby opposes the proposed amendments of the act which established that board, which amendments are intended to empower any local municipality to withdraw regulation of public utilities operating within its territory from the control and supervision of the State Department of Trade and Commerce and the Public Utilities Commission of said department, and substitute therefor a direct control by the local municipality, and further

"Be it *Resolved,* that a copy of these resolutions be forwarded to the several representatives and senators from this district, and to Governor Lowden."

ILLINOIS LEGISLATIVE MATTERS INTERESTING TO CHICAGO ENGINEERS.

Western Society of Engineers Holds Meeting to Seek Information on and Discuss Pertinent Legislation.

Another meeting somewhat out of the ordinary technical engineering meetings was held by the Western Society of Engineers in Chicago March 31. It was called by the Public Affairs Committee of the organization to inform engineers regarding pending bills before the Illinois Legislature and also to discuss their merits. In opening the meeting, President A. S. Baldwin said the average engineer has not been deeply interested in public affairs, which may have been due to the fact that in his early career he is frequently shifting his sphere of work and does not have time and opportunity enough to become interested in the local affairs of the community in which he temporarily resides. It was felt that on account of the peculiar training of the engineer he should be in a good position to discuss at least such legislation as has a bearing on technical matters.

Secretary E. S. Nethercut briefly reviewed the most important bills of technical interest before the Illinois Legislature. One of these deals with the construction of a waterway between Lockport and Utica, Ill. The initial depth of the earth sections is to be 8 ft., and of the rock sections, 10 ft. It is expected that $20,000,000 will be expended for the construction of this canal, part of which will utilize portions of the Desplaines and Illinois rivers. Several bills are pending relative to better civic administration, housing and zoning. There are also a number of bills regarding the Illinois Public Utilities Commission, most of which aim to restrict or entirely cancel its authority. Other bills have to do with the revision of the law for licensing structural engineers.

James J. Barbour, state senator from the sixth district, gave a review of the conditions in the Legislature. About 300 bills were now pending in the Senate and some 400 in the House. He explained the ordinary procedure in the enactment of laws and felt that instead of meeting every two years it would be much better for the Legislature to meet only once in 10 years. He spoke of the activities of the various lobbying groups that are present during every legislative session and the extremes to which some of them go in trying to force their pet measures through. He discussed in some detail the pending housing bill and showed that while it affected Chicago chiefly, it and many other measures affecting the city were drawn by representatives from small communities who evidently felt they knew more about improvement in the government and civic affairs of the great city than its residents themselves. Douglas Sutherland, secretary of the Civic Federation of Chicago, gave a brief review of the bills aiming to secure greater economy in city elections and in the general conduct of city affairs.

In view of several bills affecting the Public Utilities Commission of Illinois, B. H. Peck, electrical engineer of the Commission, gave a review of the work of this body since it was organized early in 1914. It consists of five members, each appointed for a term of four years. The Commission has three principal departments—engineering, accounting and railroad rates. The problems coming before the Commission are of several classes, the first dealing with rates. The law requires that rates must not be discriminatory, so that it is necessary to make a careful analysis of all rates that must be filed. Studies are also made of rates, on petition of the city, or of the customers of the utility, or they may be made at the request of the utility itself. The second class of problems deals with service, which must be adequate, sufficient and safe, in accordance with the requirements of the law. The third class deals with questions of capitalization, the Commission being obliged to approve all issues of utility stocks, bonds and other securities before such can be issued. The fourth class of problems deals with the review of contracts between utility companies and the fifth group requires the Commission to grant certificates of convenience and necessity in case a new utility is to be given the right to give service in a community which either formerly had no such service, or in which existing service is found entirely inadequate or unsatisfactory; this power is not conferred with respect to utilities operated or owned by cities.

Mr. Peck gave a general summary of interesting features in the Commission's work. Soon after it was organized a general survey of rates was made and it was found the situation was very complex in this respect, especially in smaller cities, in which many flat rates and discriminatory rates were in vogue. In such communities also there were either no standards of service or else they were inadequate. The work of the Commission has consisted both in the consideration of formal and informal complaints. The former require in many cases a very elaborate investigation of the situation, including a valuation of the property and numerous hearings; informal complaints are usually handled in a more expeditious manner, where the questions involved are not so important or can be readily determined without so elaborate an investigation. Service investigations and surveys were undertaken and have been continued. The Commission established standards for service for gas, electric, telephone and water service. The delays involved in the conduct of many cases before the Commission were due to numerous causes, among these being the necessity for a complete valuation, study of the records and history of the utility, careful review of its system of rates, contracts, etc., all of which in case of a large utility involves a great deal of time, if painstaking and judicious action is to result.

Three different kinds of rate problems have come

before the Commission. The first of these deals with the elimination of discrimination in rates, most of which was done on the Commission's own initiative; second was action on complaints, either of cities or private individuals, etc. The third was adjustment of rates due to developments in the rendering of public service, such as would result in lower cost and therefore require a reduction in rates; among the latter were many cases of rate reductions after the supply of power from the Keokuk dam on the Mississippi river was introduced into numerous adjoining Illinois cities. Other cases resulted from improvements in power-plant construction, due to use of more efficient steam turbines, improved processes of making gas, etc. Mr. Peck said that in the first four years of the history of the Commission it had been the means of reducing the cost of service to customers to the extent of over $5,800,000, and during the last year, when it was necessary to increase rates in certain cases to make up for the sudden increase in wages and other operating costs, this net saving to the customers was not materially reduced below the figure given. In these four years the Commission handled over 8000 formal cases and about 3600 informal complaints; about 1500 service inspections were made. Mr. Peck stated that the effect of the war was first noticed during 1917, when the increase in costs compelled several utilities to file applications for increases in rates. Last year in the first seven months 1075 schedules were filed as to electric rates alone, most of which sought rate increases. Mr. Peck also referred to the specific requests of former Secretary of the Treasury McAdoo and of President Wilson that utility commissions give fair consideration to utilities because of the urgency of maintaining their service unimpaired. In meeting this manifest war emergency the Commission adopted a somewhat abbreviated rate procedure in order to make valuations in a simpler manner, so as to hasten and cheapen the investigation. No radical changes in the system of rates were made and where rate increases were allowed they were only for the period of the war.

The secretary of the Illinois Chapter of the American Institute of Architects then discussed in considerable detail the proposed zoning bill, many of the absurd provisions of which he pointed out. R. F. Schuchardt, chairman of the Public Affairs Committee, stated that it was the aim of his committee to have engineers take a keener interest in topics that concern them in public matters, both as engineers and as citizens, and it is hoped to hold more meetings of this kind to discuss pending and proposed legislation.

FORMATION OF ELECTRICAL SAFETY CONFERENCE.

Representative Body to Promote Safety in Electrical Products, Safety Standards and Tests of Appliances, and Uniform Safety Codes.

Acting upon a recommendation and suggestion from the Electrical Manufacturers' Council, representing the Electrical Manufacturers' Club, the Electric Power Club and the Associated Manufacturers of Electrical Supplies, there has recently been organized a body known as the Electrical Safety Conference for the consideration of accident and safety questions relating to electrical manufacturers and products. The organizations co-operating for the formation of this Conference are the Associated Manufacturers of Electrical Supplies, the Electric Power Club, Underwriters' Laboratories, the National Workmen's Compensation Service Bureau and the Bureau of Standards, each of which is represented on the Conference by two members who have been appointed as follows:

For the Associated Manufacturers of Electrical Supplies—A. W. Berresford, Cutler-Hammer Manufacturing Co.; S. L. Nicholson, Westinghouse Electric & Manufacturing Co.

For the Electric Power Club—A. H. Moore, General Electric Co.; Clarence C. Collens, 2nd, Reliance Electric & Engineering Co., Cleveland, Ohio.

For the Underwriters' Laboratories—W. H. Merrill, 207 East Ohio street, Chicago, Ill.; Dana Pierce, 25 City Hall Place, New York City.

For the Bureau of Standards—Morton G. Lloyd and E. B. Rosa, Bureau of Standards, Washington, D. C.

For the National Workmen's Compensation Service Bureau—Albert W. Whitney and L. L. Hall, 45 Park Row, New York City.

The officers are: A. W. Berresford, chairman; A. W. Whitney, vice-chairman; Dana Pierce, secretary-treasurer.

The objects of the Conference are stated as follows:

To promote by co-operative effort the orderly, consistent and proper development of practice in electrical manufactures and installations with regard to accident hazards.

To promote the development and adoption of safety standards for the construction and test of electrical appliances and for their application and installation.

To interpret and make uniform the application of electrical safety codes, both in regard to general principles and in regard to particular classes of appliances and systems.

The active work of the Conference as between the different co-operating associations will be conducted by means of special committees appointed from time to time, which will report back through the Conference to the associations for the purpose of securing agreement and a uniformity of action.

The first subject undertaken by the Conference will be that of industrial controllers, on which a committee of which H. D. James, of the Westinghouse Electric & Manufacturing Co., is chairman, has recently been appointed. It is expected that at an early date other lines of investigation and discussion will be undertaken.

LYNN SECTION, A. I. E. E., HEARS ABOUT RADIOTELEPHONY.

Ernest F. W. Alexanderson Describes Development of His High-Frequency Radio System and Apparatus.

On the evening of March 26, E. F. W. Alexanderson gave a lecture in General Electric Hall, Lynn, Mass., on "Trans-Oceanic Radio Communication." The address covered both radiotelegraphy and telephony and was illustrated by lantern slides. S. P. Nixdorff and W. Wilbur Brown, associated with Mr. Alexanderson in experimental work leading up to the important developments described, assisted in describing some of the slides.

Mr. Alexanderson said that since the ban of secrecy has now been officially lifted concerning radio activities during the war, it is possible to announce a fact which is not known except by the experts directly connected with trans-Atlantic radio operation; it is

that the larger part of the government dispatches during the last year have been transmitted by a new radio system developed by the General Electric Co. The high-power radio station at New Brunswick, N. J., which before the war was a Marconi station and which was equipped by the General Electric Co. to demonstrate long-distance radiotelegraphy and telephony, was placed at the disposal of the Government early in 1918 to meet the urgent demands for official communication. The enterprise has been such a success that the Government has placed an order for two transmitting equipments of this kind.

It was the New Jersey radio station that dispatched the first message to Germany after the American participation in the war, and this was the message of President Wilson demanding the abdication of the Kaiser. The rapidly following exchange of messages which led to the signing of the armistice was transmitted by this station.

In the Alexanderson system, as now used, improvements have been made in each of the four stages in the transmission of a radio message which characterizes all systems of radio communication. These stages are:

1. The generation of high-frequency electric oscillations.

2. The modulation of these oscillations into the dots and dashes of the telegraph code, or modulation by the human voice.

3. The radiation of the electric oscillations in the form of waves traveling with the velocity of light over the surface of the earth.

4. The reception or detection of these waves by a suitable instrument.

The oscillating currents are generated by a high-frequency alternator, which delivers currents directly to the antenna of the same frequency as the radiated waves. One of the advantages of the alternator is its "pure wave," by virtue of which messages sent by different radio stations, each using a pure wave, do not interfere with each other. As a modulator of the electric oscillations a new device, known as the magnetic amplifier, is employed. Due to magnetic properties without moving parts, this device is so quick-acting that it makes it possible to transmit telegraph messages at the rate of several hundred words a minute, and more wonderful still, to amplify the modulation of a telephone current into oscillations powerful enough to carry the human voice across the ocean. The antenna used at the New Jersey station is of a new type, designated the "multiple tuned antenna," by means of which an efficiency of from 20 to 50% may be obtained.

An improvement in the technique of receiving radio messages which, being developed for military reasons, has become known as the "barrage receiver," is of great promise. Distances are only relative, and a steam whistle located in Germany might make such a noise as to drown out the sound of the voice calling from America. To counteract this, the barrage receiver was developed. A demonstration was made three miles from the New Brunswick transmitting station and it was found that the overwhelming intensity of the New Brunswick signal could be completely materialized so that messages could be received from European stations as well as if the transmitting station were not operating. After this demonstration the new device was immediately adopted in the official receiving stations of the American and French governments.

The new radio system described by Mr. Alexanderson is equally adapted for telegraphy or telephony. Thus it was possible by changing the control from the telegraph lines to the telephone lines from Washington for Secretary Daniels, speaking through the telephone in his office, to convey greetings to President Wilson on board the steamer *George Washington* at sea. Similar messages were sent to the President's ship on his return trip, and it is expected that on his second return the President may be communicated with while 500 miles from our shores. Radio technique has now reached the point where it needs only capital and business initiative to duplicate and exceed in speed, accuracy and economy the transoceanic cable traffic and extend the same to all parts of the globe.

BOLSHEVISM EXPLAINED TO NEW YORK ELECTRICAL MEN.

Student of Russian Developments Gives His Impressions to New York Electrical League.

Arthur E. Reinke, European engineer of the Western Electric Co., Inc., was the principal speaker at the New York Electrical League luncheon held recently at the Hotel McAlpin, New York City. Mr. Reinke said that "the term bolshevism is used very loosely and as a rule is confused with anarchism. Bolshevism, pure and simple, is radical socialism carried through to its local conclusion by brute force against any opposition.

"Everyone is asking how Russia can survive and this to me is easy to understand. The country is agricultural; factory industry is little developed. The people will simply return to the agricultural life. They will raise what they need, they will know how to weave cloth, make sheepskin coats and felt boots. The structure of the country will cause Russia to break up into some half-million self-sustaining agricultural communities. Many of the city workers will return to their relatives on the farm.

"The lack of national instinct will avoid counter-revolutionary efforts, with their attendant bloodshed. The Russian can and will endure hardships as he does the inevitable. Thereby he retards the return to normal conditions but avoids the misery of struggling against environment at tremendous odds.

"What is Russia's future? As bolshevism fails elsewhere—and it will fail—the bolshevists will moderate their actions and settle down to central processes of government and social legislation, if they have survived the growing exasperation of the masses. Bolshevism may not leave any permanent mark on the form of new Russia, but it seems almost certain that the soviet idea of government will form a permanent part of the future setup. The soviets are a typical Slav form of government, the outgrowth of the old peasant village assembly, or mir, and they fit the Slav civilization under Russian economic conditions far better than any federated form of representative government.

"The change in Russian affairs will be slow in coming; it may take years, but when it comes the revival of Russia will be startling. The people want order. It is bred in the bones of the Slavs.

"Lenine and Trotzky are not a pair of crooks and scoundrels, but clear-headed, sincere, enthusiastic radical socialists, whose power in Europe has steadily grown and who have started a campaign for bolshevizing Europe. It is as clear-sighted leaders of a movement that we must look at them so that we can wake up and fight this menace."

M. H. Roughton, Australian commissioner on in-

vestigation of exports and imports, spoke briefly on existing business relations between Australia and America. He made an earnest appeal for the affection of Americans for Australians and said he hoped that eventually there would be a better understanding between the peoples of the two countries. Maj. David A. L'Esprance, who was awarded the croix de guerre for meritorious service in France, also spoke briefly. J. M. Wakeman presided.

IMPORTANT ELECTRICAL DEVELOPMENTS IN ENGLAND.

The New Government Bill—A Director of Electrical Encouragement—Two Closely Related Advances.

The last days of February were marked by two very important events affecting coming electrical developments in the United Kingdom. The long-awaited Government measure for nationalizing the supply of electricity was introduced in the House of Commons by Wm. Short. This measure is for the setting up of a Ministry of Ways and Communications which will take over all powers and duties of different government departments in relation to railways, light railways, tramways, canals and waterways, roads, bridges and ferries, harbors, docks and piers, and also in relation to the supply of electricity. In alluding to the control of electricity Mr. Short said that probably transport was the greatest and most permanent customer of electricity, and transport depended entirely for its successful management on the developments of the industries of the country. It was thus very important that the new ministry should have control of electricity. It was suggested in some quarters that the interest of the tramways and the railways, so far as electricity was concerned, was not that of the consumer, but, said Mr. Short, the exact opposite was the case. The more industry prospered and was enabled to increase its output the more the railways and transport would prosper. Therefore there was every inducement for the railways and those that controlled them, to see to it that every individual in the country, everyone who could improve his business by the use of power, was enabled to get his power as cheaply as possible. As every person connected with electricity knew, load factor was a matter of great importance and bore largely on the subject of efficiency and cheapness on the railways. It was therefore essential that whoever had to co-ordinate or control the means of transport should also co-ordinate that which was essential to transport—namely, the supply of electric power.

The other event referred to was the decision of electrical organizations in London to launch out definitely upon their establishment of an Electrical Development Association for which the first steps were taken in December, 1917. At that date an executive committee was appointed from the Institution of Electrical Engineers and the British Electrical and Allied Manufacturers' Association and it is as the outcome of their deliberations that the new association has now been formed, in which electrical manufacturers, electricity suppliers, and installation contractors are jointly interested. The great object of the Association will be to do really effective educational and publicity work to advance the popularity and use of electricity for all purposes.

The Association has issued invitations for the post of director at $5000 per annum. The applicants are to be "electrical engineers having wide experience of the industry, and sound commercial knowledge"; also they are to possess "good organizing ability."

It will be remembered that before the war the Incorporated Municipal Electrical Association was moving in the matter of an Electrical Development Committee. Indeed it had formed such a committee but the war caused its activities to be suspended. Practically nothing of an organized nature has been possible in such a direction for four years. The movement started at the end of 1917 was however a strong one and its present action is taken after great deliberation and at a time when the whole of the United Kingdom may be considered ripe for a general forward movement to encourage the carrying into practical effect of the much increased sentiment in favor of electrical applications that the conditions of war time have unquestionably fostered. Of course almost everything depends upon the man selected for the appointment of director. Whoever he may be it is unlikely that either he or his committee will be unmindful of the invaluable experience and data accumulated by the American organization which has been at work for so many years. The temporary offices of the association are at the headquarters of the British Electrical and Allied Manufacturers' Association, 36 Kingsway, London, W. C.

EXHIBIT OF PHYSICAL APPARATUS DEVELOPED IN CONNECTION WITH WAR.

To Be Held Under Auspices of American Physical Society at the National Bureau of Standards.

In connection with the annual meeting of the American Physical Society, at Washington, D. C., on April 25 and 26, it is planned to have an exhibit of physical apparatus illustrating the application of physical principles to the solution of war problems. In view of the fact that the National Academy of Sciences will also be in session in Washington on April 28 to 30, inclusive, on which latter date there will be a joint meeting of the National Academy and the National Research Council, it is planned to hold the exhibit open through April 30, for the benefit of the visiting members of the above organizations.

The Council of the Physical Society has selected the following committee to make arrangements for the Washington meeting: C. K. Burgess, chairman, E. B. Rosa, G. O. Squier, A. W. Duff and J. A. Ames. At the meeting of this committee on March 6, F. A. Wolff, of the Bureau of Standards, was invited to serve as a member of the committee and to take charge of the exhibit.

The main purpose of the exhibit is to present an opportunity to the physicist to inspect and see in operation new apparatus developed for war purposes, whether by the research worker or the manufacturer. Exhibits will be accepted from military and naval establishments, universities, research institutions, manufacturers and individual investigators, whether members of the society or not.

Certain military establishments have already signified their intention of participating in the exhibit. To avoid duplication of exhibits and the exhibition of apparatus which, for military reasons, it may be deemed unwise to show, it is suggested that prospective exhibitors first take up with the proper authorities the question of what may be properly exhibited.

Further details can be obtained from Dr. F. A. Wolff, Bureau of Standards, Washington, D. C.

Commercial Practice

House-wiring Activity—Oregon Utilities—Commonwealth Edison's Annual Department Reports Show Big Gain

LOUISVILLE RESUMES HOUSE-WIRING ACTIVITIES.

The Louisville (Ky.) Gas & Electric Co. has again resumed its house-wiring activities after a lapse of several months during which all sales work was virtually suspended. Government restrictions now having been removed with labor abundantly available, the company is now aggressively going after this class of business, determined to regain the ground lost during the war.

A Wealth Of Comfort At Lowest Cost
MAKE ELECTRIC WIRING THE FIRST ITEM on your reconstruction program.
DO IT NOW at our low prices and take your time to pay.
ELECTRIC SERVICE is the biggest improvement you can make in your unwired property.
CALL MAIN OR CITY 2182, or use the coupon to-day.
Inquiry Coupon
Louisville Gas & Electric Company:
Send a man to give me an estimate for wiring my home.
Name.....
Address.....
Louisville Gas & Electric Co.
Incorporated
311 West Chestnut Street

Advertisement of Louisville Gas & Electric Co Opening New House-Wiring Campaign.

The accompanying illustration shows one of the first of a series of advertisements to stimulate inquiries.

It will be remembered that the Louisville Gas & Electric Co. does no house wiring. The inquiries and orders are turned over to local electrical contractors for execution.

ELECTRIC UTILITY COMPANIES OF OREGON.

A compilation recently made from the records of the Public Service Commission of the state of Oregon shows that up to the close of 1917 there had been invested $156,649,229 in privately owned public utility plants of that state to produce and distribute electricity and gas and to supply water to consumers.

In the year 1917 those utilities paid $4,305,483 to their security holders, amounting to 2¾% on the investment; and it is observed that the utility companies have been paying 6 to 9% interest on borrowed money.

The 1917 taxes paid by them amounted to $1,273,528, out of gross revenues of $13,133,169, or 9.7%.

At the end of 1917 the privately owned utilities of the state were serving 88,236 electrical customers, 55,954 gas consumers and 16,111 water users, furnishing employment to nearly 6000 persons, to whom over $6,000,000 was paid in wages in 1917.

Of the 54 companies operating in the state that produce and sell electric power, only 8 paid dividends for 1917.

COMMONWEALTH EDISON ACTIVITIES AS SHOWN BY DEPARTMENT REPORTS.

Unusual Amount of Business Carried on in Spite of War Conditions.

The annual reports of the various department heads of the Commonwealth Edison Co., of Chicago, offer in a general way, an idea of the magnitude of this company's activities. The reports this year indicate that this central station did an unusual amount of business in spite of the prevailing conditions. The reports were presented by George H. Jones, power division, Oliver R. Hogue, lighting division, Harold Wright, application bureau, and J. D. Milligan, estimating division.

In his report of the work of the power division, Mr. Jones states that, during 1918 more power business was added to the company's lines than in any previous year. The additional load thus secured totals 66,640 hp. and will produce an annual income of over $1,000,000. In addition to this permanent load several munition plants having a total connected load of about 35,000 hp. were connected up during the year but on account of their temporary character are not included in the report of the total business.

The electric truck business was never in healthier condition than at the present time. In spite of the prevailing high prices of batteries and equipment, 100 new trucks were put on the streets of Chicago in 1918, making a total of 1300 in service; and many others will be sold during the coming year as soon as the prices are reduced somewhat.

During the year seven new ice plants were connected making a total of 32, in which were produced 643,000 tons of ice and 1,543,000 gallons of ice cream, in the manufacture of which there were used 33,000,000 kw-hr. of electricity. This represents 65% of all the artificial ice manufactured in the city and 28½% of the total ice used, including both natural and manufactured.

Contracts have been secured from the city for

furnishing power for the city's pumping stations which, it is estimated, will consume 30,000,000 kw-hr. per year. Another large contract calling for a demand of 3000 kw. has been secured from Swift & Co. at the stock yards. In addition 39 contracts, totaling 18,790 hp. represent cases where isolated plants were replaced by central-station service. A considerable number of off-peak summer customers were also secured.

Following is Mr. Mulligan's report of the various classes of business secured and handled by the estimating division of the contract department during the year of 1918, and a comparison made with business transacted during the year 1917.

GENERAL WIRING, MOTORS AND APPARATUS.

	1918.	1917.
Contracts	820	982
Amount	$430,065.28	$290,474.26

This is a decrease of 16.4% in the number of contracts signed up, but an increase of 32.45% in the total amount of business.

MOTOR SALES.

	1918.	1917.
No. of motors	714	848
Total hp.	11,490.74	12,222.49
Amount	$240,301.21	$229,758.16

There was a decrease in the number of motors sold to the extent of 15.92%, a decrease in horsepower to the extent of 5.98%, and an increase in the value of the contracts for 1918 over those of 1917 to the extent of 4.39%. Water pipe thawing jobs brought in a business amounting to $5361.60.

It might be stated that the above business was handled by a force equal to only 50% of that of 1917. Four estimators entered the service of the Government and three were transferred to other divisions.

The yearly report of head lighting agent, Oliver R. Hogue, showing the activities of the various divisions, is as follows:

STORE UNITS.

No. of units	3,222
Kw. connected	599
Estimated income per year	$78,822.70

FACTORY UNITS.

No. of units	3,346
Kw. connected	669
Estimated income per year	$47,187.28

STREET POSTS.

No. of posts	44
Kw. connected	13
Estimated income per year	$ 3,775.20

RENTAL EXTERIOR BRACKETS.

No. of brackets	71
Kw. connected	21
Estimated income per year	$ 3,501.74

RENTAL SIGNS.

No. of signs	214
Kw. connected	92
Estimated income per year	$25,201.72

SIGN SALES.

No. of signs	2
Kw. connected	5
Estimated income per year	$ 1,096.08

WIRE ORDERS (HOUSE WIRING).

No. of orders	2,779
Amount billed	$67,532.34

OLD HOUSES AND APARTMENTS—WIRING.

No. of buildings	125
No. of houses	7
No. of outlets	1,856
Amount billed	$ 7,576.90

SPECIAL HOUSE WIRING—OLD HOUSES AND APARTMENTS.

Total for year	1,713
Lights	38,558
Amount billed	$245,841.47

HEATING AND APPLIANCE DIVISION.

	No. of sales.	Kilowatts.	Amount billed.
Domestic	2,175	815	$ 55,004.51
Commercial	5,657	...	80,202.14
Industrial	648	363	4,853.97
Total	8,480	1,178	$140,060.62

COMMERCIAL IRONS.

No. of sales	24
Kw.	22

IRON AND TOASTER CAMPAIGNS.

No. of sales	16,848
Kw.	9,070
Amount	$63,532.45

CONTRACT RATE ADJUSTER.

Indemnities and sales collected and number of cut-offs cancelled.

Indemnities collected	$ 2,793.10
Sales of rental investments	12,548.80
Non-payments collected	1,967.40
Total amount collected	$17,309.30
No. of cut-offs cancelled	2,427

The illuminating division assisted the salesmen in layouts for all types of special lighting. On account of the light activity in display, store and window lighting due to war conditions, the energies of this division were turned largely to industrial lighting. During the last six months of the year some very fine installations were made in this field. A class in illumination was held weekly during a portion of the year for the instruction of new men entering the department.

As in previous years, the activities and operating methods of the Application Bureau during the year 1918 have been exceedingly interesting. The principal items of interest as to method and statistics follow under their respective headings.

A combination of the "Application" and the "Read and Disconnect Order," which made possible the writing of the customer's order but once, using one copy for the application and the other as a "request for discontinuance," was developed. This combination of form saves considerable time and does not permit errors in transcription to occur, which follow where similar information is required on two separate orders.

Due to the plan adopted late in the year 1917 wherein meters for residential customers could remain disconnected on a customer's premises for a period of 18 months, it has been possible to effect a large saving in labor throughout the company and in the Bureau for the reason that successor orders require less labor, both clerical and physical. During the peak day of the year when the movement of customers was at its height, 92.4% of the total orders for this class of customer were "successor orders." Skilled labor at this time was at a premium, and labor was utilized to a greater degree by decreasing the amount of work necessary for each individual order. Better service was rendered to customers by this method, which the Bureau was instrumental in recommending.

TOTAL ORDER REVIEW.

Class.	1917.	1918.
Applications and contracts	168,781	150,171
Final readings	104,283	109,177
Meter removals	22,471	16,126
Salesmen's calls	22,143	14,525
Correction orders	18,021	13,650
Inquiries	91,205	84,653
Wiring orders	14,118	8,594
Total	440,570	378,783

TREND OF BUSINESS.

The figures given at this point show the number and percentage of residential applications received by salesmen and Application Bureau:

Source.	No.	Pct.
Application Bureau	116,380	95
Salesmen	5,719	5

The third edition of the National Service Record of H. M. Byllesby & Co. and affiliated companies is being distributed. It shows an increase of 256 men in the service since July 1, 1918, making a total of 951 so engaged or 19.7% of the organization male employes. Only 20 casualties are recorded, 9 deaths, 10 wounded men and one man missing in action.

Operating Practice

Duct Line Ventilation — Determination of Distributing Transformer Loading — Circuit Breaker Installation

VENTILATION OF DUCTS REDUCES UNDERGROUND CABLE FAILURES.

Results of Experiments by Duquesne Light Company.

After numerous cable breakdowns in certain duct sections of its 11,000-volt underground cable system, caused by rapid load increase and higher load-factor, the Duquesne Light Co. made an investigation to determine the extent to which duct temperatures could be reduced by means of external cooling.

Cables, because of the high potential between conductors and the types of insulation which have to be employed, must be operated at a much lower temperature than any other kind of electrical apparatus to insure reliable service, and laboratory tests have determined that the maximum safe working internal temperature of the 11,000-volt cable is 150° F. Safe operation, therefore, depends upon the ability to keep the internal cable temperature below 150° F. It has been determined by laboratory tests that the difference in temperature between the duct wall and the copper of the cable is approximately 54° F.

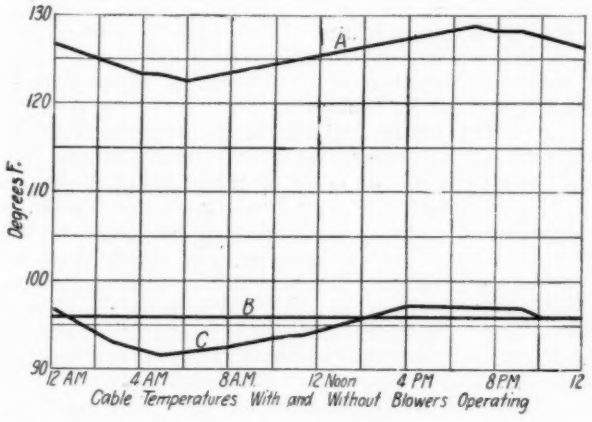
The number of cables in a given duct line and the character of the soil through which the ducts run are factors that determine the amount of load the cables can carry. The characteristics of the soil determine the rapidity with which the heat can be dissipated, while the number of cables determines the total amount of heat to be dissipated. In general, 35,000 kv-a. is the maximum load which any duct line should be called upon to carry. Several parts of the Pittsburgh company's system had exceeded this safe maximum and it was at these points that trouble developed.

In one section where trouble occurred there are ten tile ducts, built two wide and five deep, in which there are installed eight No. 4/0 three-phase, 11,000-volt cables. The street is narrow and its soil has poor heat-dissipating qualities. Several rolling mills with annealing furnaces are close to the street. Every cable in the run is called upon to carry from 200 amperes to 220 amperes during the morning and evening peaks. In the summer the load-factor is about 50% and in winter about 75%.

One summer there were thirty-eight cable failures in this section, which is somewhat less than a mile long. All these failures occurred between June 1 and October 1, and in order to relieve the situation the manhole covers were removed and left off day and night. During the following winter plans were formulated to provide for cooling this the following summer. It was finally decided to cool the ducts by the circulation of air.

At first the use of air blowers was not very favorably looked upon, as there were so few vacant ducts in the subway that there was very little free air to move. However, as this appeared to be the only feasible plan, it was decided to put it into operation. The cooling equipment consisted of eleven blowers, each having a capacity of 612 cu. ft. per minute, built into wooden frames to fit the manholes. The blowers were originally intended to draw the air out of the duct line, but on account of the restriction of the air passages the motors became overloaded. The process was reversed and outside air was forced into alternate manholes, the remaining holes being left open to allow the escape of the hot air. The temperature reduction is shown graphically in the accompanying curves. The average maximum temperature during the summer, with the blowers running, was 96° F. which on the basis of a 54° F. difference between the duct and the copper conductors is just within the safe operating temperature.

As the weather in October was cool, it was decided to discontinue the use of the blower system, but after



Curve A, June 25. No blowers installed.
Curve B. Assumed by test: temperature of ducts with cable, 150° F.
Curve C, Aug. 22. Same section of duct as in curve "A," but with blowers in service.

Atmosphere—Date.	Temperature, Max.	Min.
June 25	76°	56°
Aug. 22	81°	66°

Cable Temperatures With and Without Forced Ventilation.

a week of operation the temperature rose from 96° to 119° F., and it was found necessary to again put the cooling system in operation. The increase in duct temperature in spite of the cooler weather was undoubtedly due to the increase in load-factor on the transmission system.

Only two breakdowns have occurred in the section since the blowers were installed, both of these being due to overloads on the individual cables caused by station failures in other parts of the system.

Temperature readings were obtained by both indicating and recording pyrometers based on the change in resistance of a small copper coil, the coils being inserted at various points in the duct line after an accuracy check had been made.

METHOD OF DETERMINING PROPER LOADING OF DISTRIBUTING TRANSFORMERS.

Use of Thermometers Employed by Superior Water, Light & Power Co., Superior, Wis.

The distributing system of the Superior Water, Light & Power Co. has grown so rapidly that it became necessary to determine the most satisfactory way of determining the load on a given transformer and also the maximum safe load it may carry. The method of testing used consists of placing a maximum-registering thermometer against the coils of the transformer for several days, and reading the maximum temperature attained during that time.

This method they find more satisfactory than the usual ones. The indication is what is wanted. The insulating materials used in transformer construction can withstand indefinitely any temperature up to 105° C., and any load can be carried if no point in the transformer exceeds that temperature. Electrical equipment is rated so that it can carry full load continuously when surrounded by air at 40° C., without any part of the windings exceeding 105° C. If the load is not continuous, or the surrounding air is not at 40° C., the maximum load it is safe to carry may be considerably more or less than the rated load. The important thing to know is, not the maximum load, but whether or not the transformer is overheated. The use of a self-registering thermometer is the most direct and logical method of testing transformers, therefore.

It must be clearly understood that while the insulating materials can withstand a temperature of 105° C., it is impossible to place the thermometer at the point of highest temperature, so that some lower temperature must be taken as the maximum safe temperature as recorded by the thermometer. The standardization rules of the American Institute of Electrical Engineers specify a temperature of 15° C., less, or 90° C. There are so many variations in outside temperature and in load, that 65° C. is considered as high as it is safe to go in actual practice.

Surrounding temperatures of 40° C. or 104° F., specified by standardization rules practically never occur in distributing transformers on poles during periods of heavy loads. This makes it safe to carry a little overload on lighting transformers even in the summer time. In the winter months the load increases greatly but the cooler weather increases the ability of the transformers to carry overloads about as rapidly as the load. Statistics for maximum temperatures during the lighting peak are not readily obtainable. The following shows the mean of highest temperature during each day for Superior and Chicago. This gives an idea of the surrounding temperatures that are likely to be encountered in Wisconsin.

	Superior	Chicago
January	18° F	31° F
February	22	33
March	32	41
April	46	54
May	58	64
June	69	74
July	74	80
August	71	77
September	64	71
October	52	57
November	36	45
December	25	36

Chicago has on the average 9 days per year with a temperature above 90° and Superior has less than 2.

During the summer months the lighting peak is of such short duration, especially when the daylight saving law is in force, that transformers do not have time to reach their full operating temperature. The following table is typical of the rate at which distributing transformers heat up when full load is applied to a cold transformer and held constant, in a room temperature of 40° C.

Hours	Coil Temperature
0	40° C
½	45
1	49
1½	51
2	53
2½	55
3	56.5
3½	58
4	59
4½	60
5	61
10	64

These tables indicate that when the load is only for about three hours, a considerable overload is permissible.

Most distributing engineers probably consider fall the proper time to check up transformer capacities, since it is then that loads increase, and transformers fail from overload in the early winter. Is it certain whether the damage is done by high loads in the fall and early winter or by the combination of high surrounding temperature and moderate loads in summer? In this connection there is one thing that is likely to be forgotten. A transformer may be badly overloaded for a time and come through without failure, but it has probably been seriously injured and is ripe for failure at some later date. For this reason it seems advisable to run a series of tests on transformers carrying typical loads under both summer and winter conditions to determine at what season a transformer reaches the highest temperature.

It would appear from the foregoing that distributing transformers may be permitted to carry something of an overload with entire safety, and it is good engineering to install as small a piece of apparatus as will perform the work properly. Thermometers will tell more accurately than any other simple method whether the transformer is loaded excessively.. Tests conducted a few years ago indicated that if a transformer is surrounded by air at 0° C. or freezing, it is possible to carry a 50% overload continuously without the transformers becoming as hot as when run at rated load and standard temperature. The tests were run on old-style transformers and it would not be safe to overload new transformers to the same extent.

Where a transformer is installed in an underground vault with poor ventilation high ambient temperatures occur. Any method which measures the electrical load only is unsatisfactory because even part load may overheat the transformer. If transformers are supplying a variable load, as many power installations, it is sometimes rather difficult to determine with any degree of satisfaction whether a transformer is overloaded. The thermometer is of assistance.

The older apparatus which has been rated by the old and rather liberal standardization rules can carry a much heavier load for a given rating than newer apparatus. If the transformers are tested by thermometers the difference in capacity is automatically taken care of, the older ones showing the lower temperatures and permitting the use of heavier loads.

When a transformer is overloaded a comparatively small change in load makes a large change in the losses, and a correspondingly large change in tempera-

ture. For this reason the thermometer method is more accurate than one which measures the electrical load.

The split-ring transformer and ammeter is not accurate; if only an instantaneous reading is taken there is little assurance of getting the maximum load. If the meter is left on for some time the expense of the test is excessive. The Wright Demand meter has also been used to some extent for this purpose, but the thermometer is inherently more accurate and less expensive than either of these.

The thermometers used should have the scale etched on the glass, with no metal exposed to cause short-circuit. The registering feature should be the same as that used on clinical thermometers. It is useless to expect satisfactory results with ordinary thermometers, because the mercury drops so rapidly after the bulb is removed that it would be impossible to get accurate readings. Some care must be used in placing the thermometer. The best place is in an oil duct between windings. This can usually be done in the newer and smaller transformers. The next best place is to let the bulbs rest on the top of the core. Consistent results can be obtained, though it takes a little experience for the linemen to learn to place the thermometer properly. The atmospheric temperature should of course be noted and allowed for.

The test is not a particularly expensive one, especially as it provides an inspection of the oil in the transformers. Any and all transformers are not tested indiscriminately. This would be too expensive. If it is felt that a transformer should be changed, it is first tested to guide in the size of equipment to put in its place. To aid in selecting the transformers which are most likely to be overloaded, the following rule is applied to residence lighting consumers only. The maximum demand in watts of N consumers is $400 + 160N$, and 40% overload is permitted before it is considered necessary to test the transformer. This is equivalent to saying that the demand of one consumer is equal to a little more than one flat iron. If 20 consumers are supplied from one transformer, their demand will be 3.6 kw. and their diversity factor is 3.1. This diversity is practically that found by Gear in his investigations on residence consumers in Chicago. This rule is of course a rough rule of thumb, but it has come surprisingly close, in both the better and poorer parts of our city. If used properly, this rule serves as a method for estimating the load on transformers, and is simpler and more satisfactory than basing the demand on a certain fraction of the connected load.

With this method not more than 15% of the transformers in any one year need be tested. The cost of testing should not exceed $1 each—a high figure for the inexpensive thermometer test.

Some engineers believe in installing ample transformer capacity and save burned out transformers. Suppose, however, in a given locality one 7½-kw. transformer is installed where a 5 kw. would have been sufficient. The difference in cost is about $25. Assuming the fixed charges on this investment are 12%, the 7½-kw. transformer has an annual investment charge of $3.00 more than the smaller one. The 7½-kw. unit has about 14 watts greater core loss which at $0.01 per kw-hr. is $1.23 per year. The difference in annual cost of the two transformers is $4.23. A few cases where transformers larger than necessary are used would cause an annual loss to the company greater than the cost of the proposed method of testing.

To secure the best operating economies, it is essential to keep all distributing transformers loaded nearly to their limit. That limit is defined not by the rated capacity, but by the maximum safe temperature. How nearly this maximum safe temperature is reached is best determined by a self-registering thermometer. A limited amount of testing is a very wise expenditure.

The above is an abstract of a paper by F. A. Robbins, electrical engineer, Superior Water, Light & Power Co., read before the recent convention of the Wisconsin Electrical Association.

MOBILE ARRANGEMENT OF STATIONARY OIL SWITCHES.

Ease of Handling Feature of Installation of Minneapolis General Electric Company.

To permit of ready handling for repairs and inspection, the generator oil circuit breakers being installed at the Riverside station of the Minneapolis General Electric Co. at Minneapolis are installed upon trucks or carriages. The truck is run into position in the switch cell from tracks along the cell aisle. Once in place the unit is locked in position, connected up, disconnect switches are closed and the unit is ready for service. The circuit breakers have a rating of 600 amperes at 13,000 volts.

The circuit-breaker carriages consist of a built-up frame of channel iron upon which the circuit breakers are mounted. The carriage is bolted to the brick cellwork while the switches are in position. The trucks rest upon wheels, which in turn rest upon rails which extend from the interior of the switch cell to the passageway. The circuit breakers are connected through a special form of disconnect which can be opened only by special tools. These disconnects are in addition to the usual disconnect switch employed for routine switching.

To take a circuit breaker out of service, and remove it for inspection or repairs, the disconnect switches are opened on both sides of the breaker. The connecting conductors are removed after lifting up the floor slabs and removing the jumpers. The floor slabs are especially made so that it requires two men to remove them, a safety measure. With the circuit breakers electrically isolated, all that then remains to be done is to uncouple the circuit breaker carriage from its anchoring against the cell brick structure, and pull the carriage out of the cell into the passageway where the unit may be removed to a convenient place for repair or inspection.

The above arrangement is most simple and is not expensive. It permits a circuit breaker to be taken out of service quickly and replaced with a minimum of time lost. The procedure is so simple that there is no excuse for allowing a circuit breaker that has thrown oil or been subjected to severe service to remain without inspection.

In operating two motor-generator or frequency-changer sets in parallel the station operator noticed the power-factor of the one motor was low. He increased the field excitation of this machine continually with practically no result. Instead of checking up the working of the power-factor meter, the operator so increased the excitation that finally the line opened under the heavy lagging current. This placed too great a load upon the second motor-generator set, which also cut loose, dropping the entire load, and causing serious service interruption.

Contracting-Construction

Croft Concludes Measurement Suggestions—House-Wiring Campaign Endorsed—Fire Marshal Requests Better Wiring

MAKING MEASUREMENTS FOR FITTING CONDUIT.

Use of Small Triangle for Finding Center Distances—Use of a Sectional Rule for Bends in Cramped Quarters.

BY TERRELL CROFT.

[This is the last of three articles discussing methods of accurately measuring and laying out conduit work. These articles fit in with several series of articles on conduit construction by this well known writer that have appeared in ELECTRICAL REVIEW *within the last 15 months as follows: "Methods of Bending Conduit,"—7 articles in issues of Jan. 12 to Feb. 23, 1918; "Some Comments on Conduit Benders,"—4 articles in issues of April 27 to May 18, 1918; "Bending Racks and Roll Benders for Large Conduit and Pipe,"—5 articles in issues of June 22 to July 20, 1918; "A Few Facts About Conduit Fishing,"—7 articles in issues of Aug. 24 to Oct. 5, 1918; "Attaching Conductors to Fishing Wires and Pulling-in Lines,"—3 articles in issues of Jan. 11 to 25, 1919. In view of the steady increase in conduit construction, electrical contractors and wiremen will find these series of articles of considerable value.]*

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A Small Triangle May Often Be Applied Conveniently for Locating the Center of a Fitting Outlet. Fig. 9 shows the details of such a triangle which can be cut from a thin piece of wood or from fiber or sheet metal. Figs. 10 and 11 show the method of its

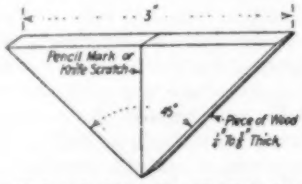


Fig. 9.—Wooden Triangle Used for Finding Center Locations of Outlets.

application. To obtain the distance between centers of two outlets, place one of the triangles in each of the outlets and measure between them as indicated in Fig. 10. This method is the most valuable where the two outlets are of different diameters. Where the two outlets are of the same diameter, the method of finding the distance between their centers described below and illustrated in Fig. 12 is the preferable one. To find the distance between the face *F* and the center *C* of the outlet of a fitting, the triangle may be utilized as diagrammed in Fig. 11.

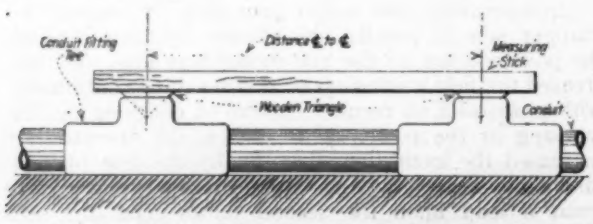


Fig. 10.—Two Wooden Triangles and a Straight Edge Used for Finding Center to Center Distance.

To Obtain Directly the Distance Between Centers of Two Round Outlet Holes of the Same Diameter, measure between the right-hand edge of one hole and the right-hand edge of the other hole (or between the left-hand edges) as suggested in Fig. 12, where the

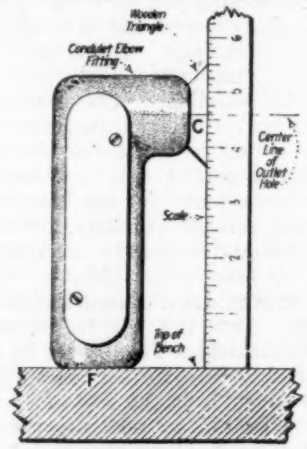


Fig. 11.—Finding Distance from End to Center of Outlet of a Conduit Elbow with the Wooden Triangle and a Rule.

distance *L* between *A* and *B* equals the center-to-center distance between fitting outlets.

A Method of Obtaining the Measurement for an Offset Piece Which Is to Be Bent at an Angle to Fit and Which Is to Be Installed in a Confined Space is shown diagrammatically in Fig. 13. The method was first proposed by C. B. Hutchinson in the ELECTRICAL REVIEW for Oct. 7, 1914. In this illustrative example it is assumed that it is required that a piece of conduit be cut and bent to extend between the end of the pipe *C* which has been placed and the hole in the outlet box to be installed at *H*. Inasmuch

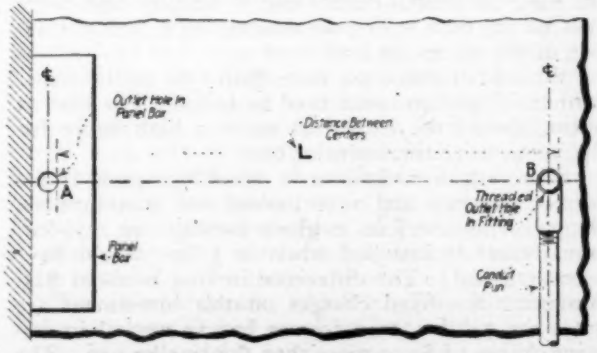


Fig. 12.—Measuring Distance Between Centers of Outlet Holes.

as the ceiling or attic space shown is only about 50 in. high in the clear, the conduit cannot be bent in it. It must, therefore, be formed in the room below and is then most conveniently passed, after being bent by the helper, through the outlet hole *H* to the journey-

man who is working in the attic space. The problem then encountered is how may the journeyman, who is working above, advise his helper below as to just how long the piece of conduit is required to fit between *C* and *H* and where the bend should occur in it.

A six-foot rule may be used to determine the contour of the connecting piece required between *C* and *H*. By calling certain readings from the rule the journeyman advises his helper of the dimensions of the connecting piece which is required. The rule is adjusted until one joint *E* points toward the outlet box hole and one end *D* points toward the end of the existing conduit. The remainder of the rule is so folded that it forms a triangle, the dimensions of which are immaterial except that the base *SE* of this

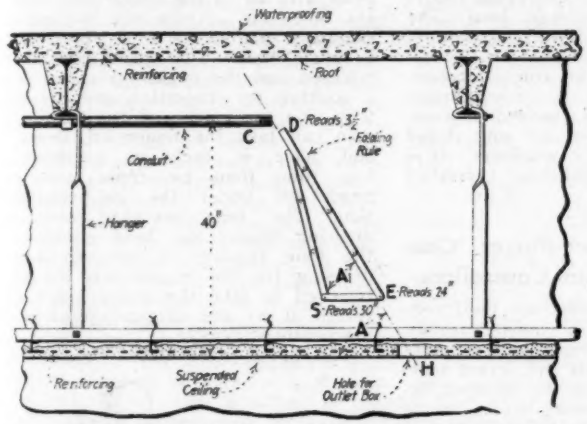


Fig. 13.—Determining the Angle for a Bend in a Confined Attic Space.

triangle must lie parallel with the surface of the ceiling. The rule having been folded as shown in the illustration, the journeyman calls out the readings at the points where the rule changes direction. Then his helper on the floor folds his rule so as to correspond with the readings given to him. Now the helper knows that the vertical distance between the ceiling of the room and the center of the conduit is 40 in. Therefore, he can with his own six-foot rule duplicate the angle A_1 and can, by making a full-size layout on the floor, bend the conduit so it will fit.

For example, with the rule folded as shown in Fig. 13 the journeyman would call out to his helper $3\frac{1}{2} - 24 - 30$, indicating the readings at points *D*, *E*, and *S*. The helper would then fold his rule so that the triangle it found would be a duplicate of that made by the rule in the ceiling space.

After the helper has bent the connecting piece, he screws a coupling on the upper end of it and passes it through the outlet-box hole *H* for connection by the journeyman to the conduit run *C*.

PRESIDENT OF CHAMBER OF COMMERCE ENDORSES "ELECTRIFY YOUR HOME."

Harry A. Wheeler Commends House-Wiring Campaign of Society for Electrical Development.

Harry A. Wheeler, president of the United States Chamber of Commerce, in a letter to J. M. Wakeman, general manager of the Society for Electrical Development, has manifested his approval of the society's nation-wide house-wiring campaign. The greater use of electric service, Mr. Wheeler agrees, is a benefit to the community and should be fostered everywhere.

It is Mr. Wheeler's opinion that the nation is on the road to great prosperity, but that the driving must be done carefully. People and industries, he says, need time to readjust themselves, and a too rapid or forced stimulation will be dangerous. The electrical campaign, however, he feels is a necessary one for public and private good and should be backed throughout the country.

Mr. Wheeler's letter reads in part:

"Obviously I must approve the nation-wide campaign of your society for urging greater use of electric service, not from the standpoint of stimulation which it might supply to your business and others related, but rather because the greater use of electric service improves the standards and conveniences of living, and as such is to be encouraged everywhere.

"Prosperity is just around the corner, but if we try to make the turn too quickly we may suffer a spill. An effort to stimulate public work whether necessary or not, just for the sake of starting things, is economically unsound and will bring about serious reaction. A legitimate campaign to do whatever is necessary in private or public work at the present time is a campaign of common sense."

STATE FIRE MARSHAL DEMANDS HIGHER STANDARDS OF WIRING.

Requires Conduit or Armored Cable in Public Buildings and Use of Safety Switches Except on Switchboards.

John C. Gamber, state fire marshal, Department of Trade and Commerce, Springfield, Ill., has issued orders aiming to minimize the electrical fire and accident hazards. All electrical wiring is required to be installed in accordance with the National Electrical Code, and in all public buildings or buildings with hazardous occupancy the circuits must be in conduit or flexible armored cable.

The marshal has also issued an order that requires that all knife switches, except on switchboards and panelboards, must be of approved safety enclosed type and so arranged that they can be operated by a suitable handle on the outside of the box when the door of the box is closed. It must be possible to lock the switch in "off" position when required. The cover of the case must have means for locking or sealing it. A grounding device must be provided to permit grounding the case when required. The switch must be conveniently placed so that the current may be cut off at any time by the occupant, watchman, electrician or fireman, should occasion demand this.

HOUSE WIRING ACTIVELY CARRIED ON IN CHICAGO.

An unusually large number of existing residences and apartment buildings in Chicago is now being wired because of the scarcity of modern apartments and dwellings due to the very small amount of new building conducted during the last two years. Old buildings are therefore being rehabilitated, which means, among other things, installation of heating, plumbing and electric lighting systems. Many electrical contractors have taken up this house-wiring work to tide over the otherwise dull period till new construction is resumed and are engaged in actively soliciting this kind of business. Interesting features connected with co-operation by the contractors and central station will be described in our next issue.

New Appliances

Solderless Connector—Lighting Plant—Contact Finger—Reversing Switch—Furnace—Roll Warmer—Bus Support

New Dossert Solderless Connectors for Wires No. 8 to 14.

Dossert & Co., 242 West 41st street, New York City, announce a new type of solderless connector for splicing small wires. It is designated as Type D Dossert two-way connector and consists of male and female threaded parts acting upon a slotted tapered

New Dossert Connector, Type D, No. 8.

New Dossert Connector, Type D, No. 14.

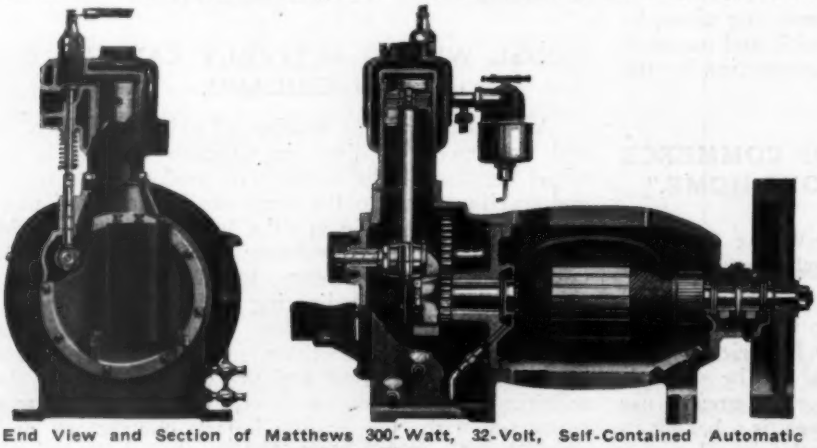
sleeve or bushing and making the splice secure by compression. These connectors are supplied in two sizes, No. 8 being for use on No. 8 and No. 9 wires, and No. 14, which can be used to connect No. 10, 12, or 14 wires, as desired. The illustrations, however, show the actual size and detail of these connectors.

Matthews Farm Lighting Plant of Small Size and Rating.

The Matthews Engineering Co., Sandusky, Ohio, has added to its line of full automatic lighting plants, which heretofore has consisted of 1, 2, 5, and 15-kw. sets, a new size known as the "Little Husky." It carries a 300-watt continuous rating on the generator, equal to 15-light capacity.

This plant is made for the 32-volt system, this being standard for plants of this kind. It is direct-connected. The generator frame and engine crankcase are cast integral. The engine is a four-cycle water-cooled type with 2-in. bore and 3-in. stroke. The plant is guaranteed to have 35 per cent overload capacity. A 60-ampere-hour Willard glass-jar lead storage battery is used with the plant.

Main bearings are 1 3/16 in. diameter, 2 in. long. The connecting rod is 1 in. diameter and 1⅜ in. long. The ignition is from a 32-volt spark coil, and the breaker is mounted on the end of the camshaft. The coil is mounted on the end plate of the crankcase. The armature is the standard laminated drum type, hand-wound with closed slots for retaining the windings. It is impregnated with Bakelite, varnished and baked.



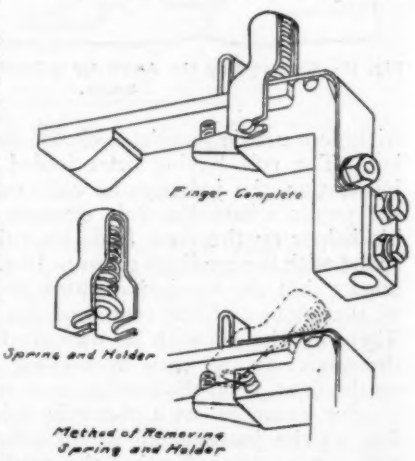
End View and Section of Matthews 300-Watt, 32-Volt, Self-Contained Automatic Lighting Plant.

Improved Contact-Finger Construction for Drum Controllers.

Drum type controllers are used very generally for cranes, hoists, trucks, tractors and other heavy-duty motors subjected to overloads and severe service. In spite of magnetic blowout devices considerable arcing occurs at the contact-fingers, necessitating more or less frequent attention. To minimize the trouble thereby involved, the Union Electric Manufacturing Co., Milwaukee, Wis., has developed an improvement consisting of a new spring tension which does away with the stud post and at the same time protects the tension spring from injury. Drum controllers are, as a rule, subject to severe service and the continual making and breaking of circuits soon pits the fingers, making it necessary to have the fingers dressed by a reliable and expert repair man. With the old type of finger in common use in order to dress the finger tips and segments considerable time was required, as several cotter pins, washers, springs, nuts, etc., had to be removed. A repair man was actually required to carry a complete tool kit to do the job thoroughly. Considerable time was lost and quite often drum controllers were neglected, due to the fact that the time required to dress the fingers was more valuable than keeping the controller in fair operative condition.

The new type of finger, which is called the "Union Perfect Type," does away with all of the cotter pins, washers, bolts, etc. A file and a piece of sandpaper are all the tools required by a repair man. The spring tension is released and the finger opens out into a position for inspection and dressing with one movement of the hand. A man can take the finger off, dress it and have it back in position in less time than he could take the finger off under the old construction. The time actually saved in dressing fingers has been reduced to the time required to do the actual dressing for the reason that the time required to take the finger apart and return it to the original position is practically negligible.

This finger is of special design, consisting of a strip of hard-drawn brass, hinged at the back into a bearing which is part of the finger base. On the opposite end is a renewable tip of cast copper hammered cold to harden and held in position by two rivets. This tip is renewable and can be removed by knocking off the rivet heads and inserting a new casting which has the rivets cast integrally in it. The fingers are held firmly against the copper cylinder segments by a steel coiled tension spring over which the new style copper-plated steel cap fits and holds in position. Adjustment is taken care of by a set screw which is locked and held in position by a brass lock spring. A pig tail of laminated copper strip runs from the finger bar to the base, making good electrical contact all the way through. Another feature is that the fingerboard can be removed from the drum without disturbing any other part of the controller.



General View and Details of New Contact Finger Construction.

New Oil Reversing Switch for Large Motors.

High voltage slip-ring motors built for steel mills, mine hoists and similar duty require some form of switch to connect the primary winding to the lines, especially so when the motor is used for reversing service. The accompanying illustrations show a new primary oil reverse switch that has several new and interesting features. It consists principally of two 3-pole switch units each operated by a high-torque motor.

Among the unique features of this switch are the unit tank construction and the means of lowering the tanks for inspection, repairs and renewal of oil. Unit tank construction is used because it increases accessibility and saves time and labor in locating trouble and making repairs. A double windlass with cables and pulleys permits easy lowering of one or more tanks. In the end view one of the tanks is lowered and shows the simple construction of the stationary and moving members. It will be noted that the arc is broken horizontally rather than vertically. This construction allows the arc to rise to the point of rupture without burning parts not designed for such duty. Since the rupture takes place near the top of the oil, it is well away from all sediment; hence frequent inspections and renewals are unnecessary. The support for the stationary and moving members is bolted to a channel iron, which in turn is bolted to the main frame, consequently in case of serious damage to any single-pole unit the complete unit may be removed without disturbing any of the others. The tanks are lined with a heavy asbestos material to prevent groundings of any live parts in case the tank is pushed out of place and also as an additional safeguard in case of sludging of the oil.

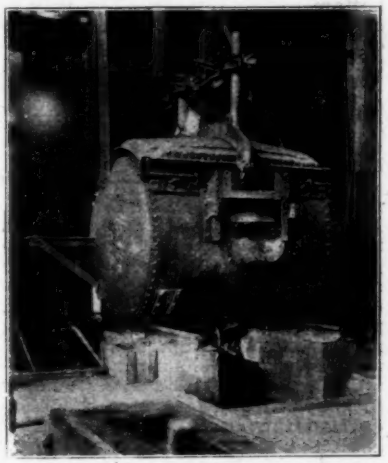
The contactor panel shown at the extreme right is controlled from a master switch or push buttons and handles the motor currents. Very little current is required as the motors used have high-resistance rotors. This particular reversing switch was made by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., for a 1200-hp., 220-volt, mine-hoist motor. It may be used for two motors on non-reversing service, or where only one non-reversing motor is required the switch is made with only one 3-pole unit and one motor.

Greene Electric Melting Furnaces for Small Foundries.

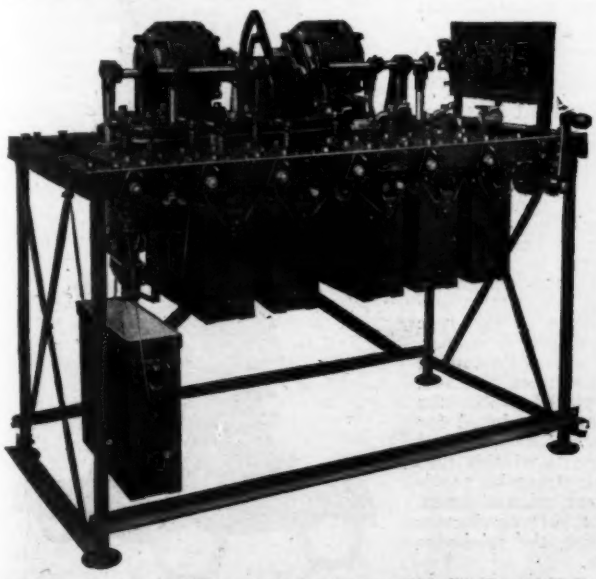
A typical installation of an electric furnace for melting steel and iron for castings is shown in the illustration herewith. This is a No. 2 Greene arc furnace, made by the Greene Electric Furnace Co., Seattle, Wash. The furnace shown here, although rated at less than 1500 lb. charge, is actually melting regularly charges of 2000 lb. of steel scrap. This furnace is connected to a two-phase power line of the Pacific Northwest Traction Co., at Everett, Wash., and is installed in the plant of the Everett Steel Co. there. The power line is 2200 volts and the two furnace transformers are each 200-kva. and of Moloney manufacture. The secondary voltage applied directly to the furnace is about 110. The furnace has two top movable graphite electrodes of 4 in. diameter. These are light and strong and easily screwed together when more electrode is required as a result of the consumed electrode material in the furnace chamber.

The electrodes are controlled by hand-operated worm gears, which can be seen in the left-hand background of the picture. Cables from the drums on these hoists operate over sheaves to hoist or lower the electrode holders. This construction of the hoist is simple and inexpensive, and, as a furnace operator must be kept on hand at all times, the advantage of the additional cost of automatic control for small furnaces is not yet determined.

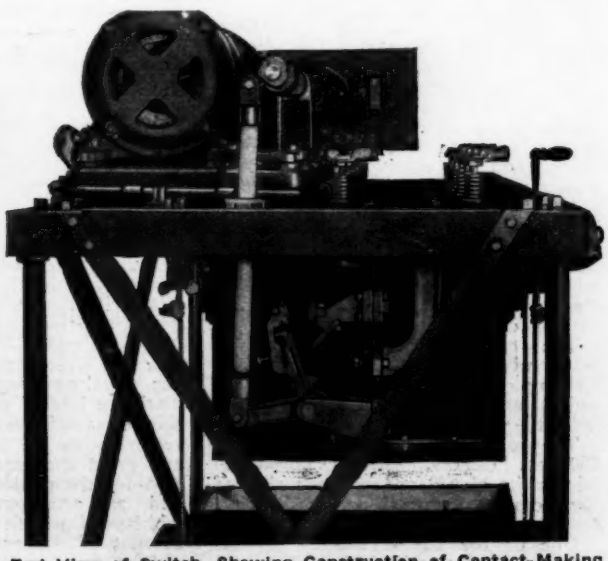
However, the construction of this furnace provides for the use of automatic-control motors if the purchaser desires to install these at his own expense. This he may do when he purchases the furnace or at any future time. There is a simple panel which provides for the ammeters by which the operator controls the current through each arc, and a voltmeter which may be switched on either phase by a switch plug; space is also provided for the central station's watt-hour meter and for a curve-drawing meter which serves to keep the furnace operator within his limit of power demand. This arrangement of curve-drawing meter on the same panel with the ammeters has proved a great saver of power. The foundry has in the chart from its curve-drawing meter an exact record of power at all times and of when each heat was started and stopped and of all interruptions of operation. In addition to the meters, the switch handle for operating the oil breaker for the furnace is also located on this panel in close reach for the operator. The transformers are connected in solid with the furnace terminals on the 110-volt side



Installation of a Greene Electric Furnace at Everett, Wash.



Primary Oil Reversing Switch for Large Motors. Operated by Two High-Torque Motors. Double Windlass for Lowering the Unit Tanks.



End View of Switch, Showing Construction of Contact-Making Members. The Arc Is Broken Horizontally Rather Than Vertically.

and disconnection of the current source is done on the 2200-volt side.

The new design of these furnaces provides three electrodes and is for three or two-phase service. In this design there is an electrode in the bottom of the furnace. The voltage of the secondaries of the transformers is applied between each top electrode and the charge, giving the full 110 volts on the arc. For subsequent operation the voltage of the secondary may be applied to two arcs and so the 110 volts be divided equally between two arcs.

These furnaces are capable of melting a heat in about three hours. It is important for the foundryman to realize that fast melting is not dependent on the furnace nearly so much as the operation. Thus, if the foundry can afford to pay for a large power demand at all times during running, then the operator can force more energy development in the furnace than if he uses a lower number of kilowatts and take more hours to develop the energy. On the other hand, the small foundry is more concerned with keeping its power bill low and securing a market for all the castings possible so as to keep operating all day every day.

These Greene arc furnaces are designed for the small foundry. They are intended to work in as an adjunct to the gray-iron foundry business. Thus it is not essential to make the electric furnace carry the burden of overhead of the whole foundry but the electric furnace can be operated just as fast as business can be built up for its product.

Where there is no cupola the electric furnace can be used to make both gray iron and steel and in this way make it possible to get business and develop a market where either the cupola or the electric steel foundry alone would be more handicapped.

Electric Roll and Food Warmer for Restaurants, Etc.

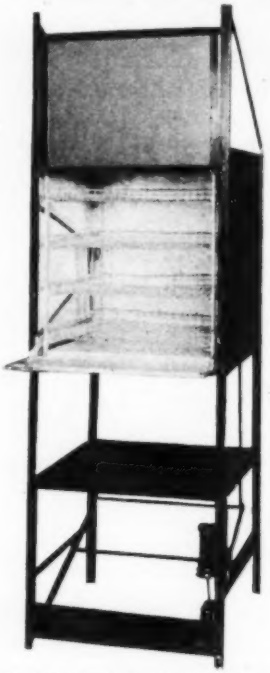
Restaurants, hotels, clubs, hospitals and similar institutions have occasion to keep food warm, for which purpose the Duparquet, Huot & Morense Co., 108 West 22d street, New York City, has placed on the market the electric warmer illustrated.

This appliance, while designed to keep rolls warm and fresh, should find extensive use as a food warmer owing to the small amount of current consumed and the arrangement for supplying moist heat. The moist heat is automatically supplied by a sight-feed device with water tank connected to the house water supply or filled by hand as desired and shows the amount of water supplied at all times; this water is evaporated by the electric heating element.

The current consumption is 600 watts, which can be obtained from any lighting circuit and is controlled by a switch mounted on the warmer with indicating pilot light.

The roll warmer is heated by two 300-watt General Electric sheathed-wire units placed one on each side of the compartment and arranged to allow free circulation of the heated air.

One of the novel features of this warmer is the self-closing door arrangement, the door being made in two sections, the upper part sliding up while the lower portion drops down and forms a shelf which can be used to set the bread tray on while filling. The door-opening device consists of an arrangement of levers actuated by a foot bar extending across the front of the warmer and placed flush with



Electric Roll and Food Warmer Opened to Show Interior Arrangement.

the front, thereby avoiding any projecting part. An adjustable air cushion is provided to prevent the doors from closing too rapidly. Pulleys, chains and counterweight are eliminated.

This warmer is ordinarily constructed of galvanized iron double-walled, insulated with air-cell asbestos. Special warmers, however, can be made of American Russia iron with polished steel or nickel-plated trimmings or polished monal metal throughout. Four tinned-wire shelves are provided, each 25 in. square, to place the rolls on.

Heavy-Duty Insulating Supports for Alternating-Current Buses.

The use of low-voltage three-phase systems by the large industrial companies has resulted in the development of power systems that generate and distribute such currents in very large amounts. This practice has made it necessary for engineers to give considerable attention to the design of busbars and insulating supports to satisfactorily handle systems of this type with the minimum amount of copper.

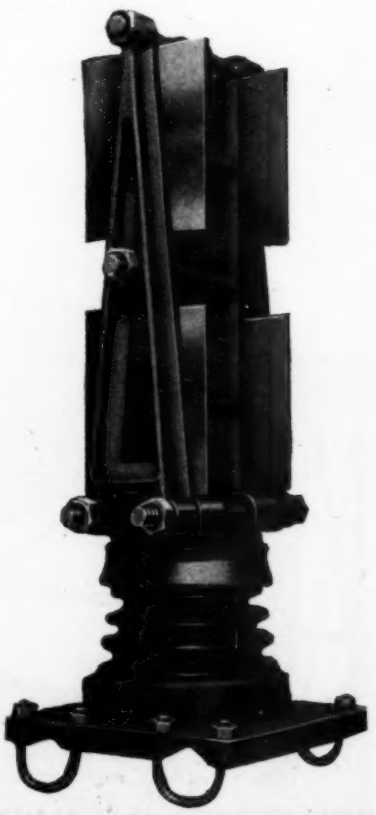
The Electrical Engineers' Equipment Co., 710 West Madison street, Chicago, has developed and placed upon the market a line of supports designed for this class of service. The principal requirements for supports of this type are great mechanical strength, provision for the proper ventilation of buses, and an arrangement of conductors which will permit using the minimum amount of copper.

A support of this type is shown in the accompanying cut. It is arranged for carrying four ¼ by 5-in. bars and to mount upon two parallel 1¼-in. pipes. Enormous strains will be exerted between buses carrying large currents under short-circuit conditions. These maximum strains are carefully calculated and all supports are designed to withstand this maximum short-circuit strain and at the same time provide a proper factor of safety.

In order that the skin effect will be reduced to a minimum, the busbars are arranged in the form of a rectangle and held in place by means of non-magnetic spacers clamped to the supports. The arrangement of the bars in this manner approximates a ring or copper tube condition, which is the ideal shape for an alternating-current conductor. All of the bars operate at approximately the same temperature and at the same current density. This is not true when vertical bars are placed side by side in the ordinary manner. With this latter arrangement, the skin effect, inductance and reactance will force the current into the outer bars and cause them to run warmer than the inner ones.

Insulating spacers are also supplied for inserting between the different phases to stiffen the structure. The buses when assembled with the supports and spacers, form one solid compact structure of great strength and rigidity.

While the Electrical Engineers Equipment Co. has standardized this type of support, there are always local conditions which influence the design. A careful study of each installation is necessary if the best results are to be obtained. On one recent installation, several thousand dollars worth of copper was saved by giving proper attention to the design of the buses and supports.



Busbar Support for Carrying Rectangular Buses for Heavy Alternating Currents.

Trade Activities

American Blower Plant to Be Enlarged—The Conlite Co. Enters Engineering-Contracting Field—Valuable Catalogs

Boggis-Johnson Electric Co., Milwaukee, Wis., jobber of electrical supplies, on May 1 will remove from 127 Second street to 346 East Water street, where larger and more desirable quarters have been engaged.

The Colwell Storage Battery Co., of Waukegan, Ill., has purchased the Wetzel Building and will remove to the new location during the next few weeks. The new building is 120 by 130 ft. in area and the company will have the use of three floors.

The United Electric Co., of Dubuque, Iowa, has been incorporated with capital of $15,000 to deal in electrical supplies and to do a general electrical contracting business. Joseph Lowe is president and C. J. Willing is secretary of the company.

Western Dry Battery Co., manufacturer of Bull Dog dry cells, has moved into its own two-story factory at 15th avenue West and Wheeler street, Seattle, Wash., which provides 6500 sq. ft. of floor space. James Bennett is president and Roy Bennett is manager of the company.

W-H-Y Electric Equipment Co., 807 Grand avenue, Milwaukee, Wis., has changed its corporate title to W. Frank Horn Co., Inc. The company manufactures industrial and automotive electrical equipment. W. Frank Horn is president and treasurer, and Lafayette Yakes, secretary.

Sorgel Electric Co., Milwaukee, Wis., recently issued a price list of new and used electrical machinery and apparatus in stock. The list includes both direct and alternating current motors, elevator controllers, drum controllers, exhaust fans, pressure blowers, air compressors, etc.

Flexible Steel Lacing Co., 522 South Clinton street, Chicago, in a circular recently distributed discusses lamp security by means of Flexco-Lix lamp guards and split-handle portables. These devices will eliminate lamp loss and breakage and will withstand the roughest usage and abuse.

Automatic Reclosing Circuit Breaker Co., Columbus, Ohio, has issued Bulletin No. 301, describing its new types of automatic reclosing circuit breakers "ARL," "DRL" and "CRL." These are shown diagrammatically and their operation, theory of operation, adjustments and application explained.

CoKal Stoker Co., 48 West Division street, Chicago, is distributing a leaflet illustrating and describing the CoKal stoker. The salient features of construction and the advantages afforded of the stoker are described and directions for its operation, accompanied by drawings, are included in the circular.

The Trumbull Electric Manufacturing Co., Plainville, Conn., has sent out a notice stating that it has discontinued the sale of insulating joints and hickeys. All orders now in the works will be filled but no further orders can be taken.

The Power Specialty Co., 111 Broadway, New York, is enjoying a splendid business and reports having recently secured orders for the installation of superheaters in waste heat Edgemoor boilers for the Knickerbocker Portland Cement Co., Hudson, N. Y., and the Huron Portland Cement Co., at Alpena, Mich.

Davis Slate & Manufacturing Co., Chicago, is distributing Fair-List No. 7, which gives the list prices and shipping weights for the complete range of sizes of electrical slate and marble. It is a well printed booklet of 24 pages and contains much information of interest and value to electrical engineers and switchboard builders.

St. Cloud Electrical Co., Fond du Lac, Wis., recently incorporated, will engage in the manufacture of electrical farm lighting plants, both direct connected and belt driven, and will also specialize in electric wiring. The incorporators are F. C. Clark, Frank Kohlman and O. Koll. The new plant which the company is putting on the market is to be known as the "Soloray" light plant.

The C. T. Coe Co. has purchased the property of the Hafer Foundry & Machine Co., Chambersburg, Pa., and removed its plant from Newark, N. J., to Chambersburg, where it will continue to manufacture Coe turbine blowers and Coe sectional grates in addition to the Hafer patent soot blowers and Hafer shaking grates. The company will also produce a complete line of boiler specialties.

The King Manufacturing Co. is the name of the corporation that has taken over the business of the King Foundry Co., St. Joseph, Mo., manufacturer of King White Way posts and other outdoor street, boulevard and park lighting equipment. The new company is planning on adding several kindred lines of manufacture to its already well established products. Announcement of these added products will be made at an early date.

American Blower Co., Detroit, Mich., has purchased a tract of 20 acres in the northeastern section of Detroit, on which it proposes to erect a plant to cost approximately $750,000. The manufacturing business of the main plant at 1400 Russell street will be removed to the new location and the former plant used for other purposes. It is expected that the new plant will greatly increase the company facilities and make possible the employment of larger working forces.

Crescent Electric Supply Co. will in the near future occupy the Lock Building on Iowa street, just south of Eighth street, Dubuque, Iowa, with a complete stock of electrical merchandise and will also do an electrical contracting business. The capital stock of this new company is $50,000. T. F. Kelly is secretary of the company.

Victoria Electric Supply Co., Ltd., 77 York street, Toronto, Ontario, is now the exclusive Canadian distributer for the lines of glassware manufactured by the Eagle Manufacturing Co., Wellsburg, W. Va., who make a large and varied assortment of plain and decorated shades and bowls. Large stocks of Eagle glassware will be carried at both the Toronto and Montreal warehouses, the latter being located at 52 Victoria Square.

Esterline Co., Indianapolis, Ind., engineer and manufacturer of graphic meters, permanent magnets, etc., is mailing a circular entitled "Power-Factor Survey." This circular is one of the series sent out to operating companies, and other companies concerned with the use of electricity. With the circular is enclosed a letter that forcibly brings realization of the powerful influence that power-factor plays in electric generation and distribution. To quote, "When we discover that a manufacturer has shipped us a generator, a motor or a transformer which is overrated, it is rejected forthwith or a price adjustment demanded. How then can we be so patient with ourselves when we are hooking our electrical equipment into systems in which preventable low power-factor is robbing us of 10%, 20% and in some cases 30 to 40% of our rated capacity. Low power-factor is a good deal like Bright's disease, we can have a bad case of it in our system and not know it. It takes a specialist to find it, if he gets hold of us before the undertaker does. In the investigation of power-factor conditions, an Esterline graphic power-factor recorder in the hands of an engineer makes him a specialist on the subject. Continuous records can be made night and day on each part of the system, the causes localized and the remedies prescribed. Since the causes of low power-factor are found mainly in industrial plants, this is a subject of interest and importance to central stations, consumers and plants which generate their own electrical power." The above-mentioned circular discusses power-factor in a practical way, showing by records from an installation power-factors as they existed before and after correction. This circular should appeal to all in any way concerned with alternating-current generation, transmission and utilization.

Edison Electric Appliance Co., Chicago, is distributing to dealers a very attractive broadside produced in colors which features the Hotpoint iron. This is a reproduction of the Hotpoint iron advertisement in the May issue of the Ladies' Home Journal, opening the extensive Hotpoint advertising campaign for 1919.

Dakota Electric Co., Sioux Falls, S. D., was recently incorporated by a number of Sioux Falls men and will make a specialty of handling wholesale electrical supplies. The corporation has been capitalized for $250,000. N. C. Draper, for several years manager of the Northern States Power Co., is one of the organizers of the company.

Quigley Furnace Specialties Co., Inc., engineer and contractor, 26 Cortlandt street, New York, is distributing Bulletin No. 11 dealing with the Quigley powdered fuel system for preparing, distributing and burning powdered fuel. It is devoted principally to a description of the Quigley method and apparatus for distribution and burning and is profusely illustrated with halftones, diagrams and charts to clarify the text.

Chicago Insulated Wire Co. sustained a loss of $150,000 when fire recently destroyed a portion of its plant at Sycamore, Ill. The original building, 300x60 ft. in dimensions, was completely destroyed and several other buildings badly damaged, including the heating and power plants, machinery and a considerable stock of copper wire and cotton for insulation. The plant was said to be the largest factory producing insulated copper wire in the Central West.

The Palmer Forced Draft Slack Burner Co., Fort Scott, Kans., manufacturer of Palmer forced draft burners for steam boilers, has issued a valuable little bulletin entitled "Conservation of Fuel," which offers a solution to the fuel problem. It contains a detailed description of the Palmer burner system and points out how certain existing losses in fuels may be reduced to a minimum. It enumerates the losses on a hand fired, natural draft furnace and on a Palmer system burner and tells how these conditions may be remedied. It emphasizes the importance of knowing the efficiency of boilers, and in this connection offers charts and tables showing how this can be determined. Numerous pages are devoted to views of recent installations of the equipment and testimonials from many companies telling of the excellent results obtained from the Palmer system.

Wheeler Condenser & Engineering Co., Carteret, N. J., is distributing Preliminary Bulletin No. 113, illustrating and describing the Wheeler steam jet air pump. This patented steam jet air pump includes the valuable feature of two or more steam jets working in series with a condenser between the jets—a feature which enables this type of pump to perform a given duty more efficiently than any steam jet pump not so equipped. The bulletin explains the operating principles, reasons for high efficiency, minutely describes the inter-condenser, cites an interesting case of unprejudiced testimony and shows an operating test curve. It includes a cross-sectional drawing and shows how to connect double machines or triple machines to surface condensers. The pump is applicable to jet condensers, as well as to surface condensers.

United Gas Improvement Co., Philadelphia, has organized the U. G. I. Contracting Co., which will not only engage in engineering and construction problems, but will include an up-to-date selling organization to take entire charge of the sale of by-products. The construction of manufacturing apparatus and the sale of by-products have been heretofore divided among several departments of the parent company, but in the future it will be handled by the new company. It will design and erect power and gas plants, and together with the sale of residuals of all kinds, will have a special road division competent to construct and maintain roads and highways under contract. The company expects this latter phase of the work to be a most important one for the reason that most communities are making very broad plans for the general improvements of their highways. Paul Thompson, one of the vice-presidents of the United Gas Improvement Co., is president of the new organization. J. A. P. Crisfield is vice-president in charge of engineering, and D. J. Collins, vice-president in charge of sales. The staff of the company will include many engineers and sales experts now connected with the parent organization, who have been engaged in these particular duties for a number of years. The offices of the U. G. I. Contracting Co. will for the present be in the U. G. I. building, Philadelphia.

The Conlite Co., Inc., 208 South LaSalle street, Chicago, has entered the engineering and construction field and promises to be one of the most enterprising and successful organizations in the industry. This concern was recently incorporated and has a capitalization of $1,000,000. The company will engage in the construction of underground conduit; transmission lines and plants for power, light, telephone and telegraph systems; commercial and ornamental lighting systems, employing gas or electricity; mass concrete work; sewer systems; and allied construction into which the above classes of work enter. A competent supervisory force has been employed and connections made with an adequate force of skilled and unskilled labor, thoroughly conversant with the branches of work in which it engages. This enables the company to guarantee its clients, not only economical prices, but harmonious co-operation and efficient and prompt completion of the work to which it is intrusted. The facilities of its organization are at the disposal of its clients, either for the dissemination of information or for furnishing preliminary costs of contemplated work. The Conlite Co. would appreciate the opportunity to submit bids on proposed construction, irrespective of location or size, involving any of the different classes of work enumerated above.

Leeds & Northrup Co., Philadelphia, in a recent bulletin entitled "Checking Thermocouple Pyrometers," discusses the importance of maintaining standards and of checking in pyrometry. Causes of and methods for the prevention of errors in pyrometer equipment have been given little or no publicity up to the present time, although the failure and rejection of a large percentage of many products may be traced directly to such inaccuracies. There are many opportunities to increase efficiencies by the use of pyrometers in steam and gas making plants as well as in many industries. Many of the most common errors found in pyrometer installations are due to simple causes which could be easily remedied if the user were acquainted with the necessary precautions to be observed in the installation and care of his instruments. In view of these facts, the publication of this bulletin by the Leeds & Northrup Co. is particularly timely and of considerable interest to those employing the pyrometer in their operations. It points out sources of error and the remedies for troubles in thermocouples, millivoltmeters, cold junctions and potentiometers, and outlines a commercial checking laboratory, including a special checking furnace, precision potentiometers and standardized thermocouples. This bulletin is distributed free of charge and should be in the hands of every manufacturer, the quality of whose product depends upon temperature control by pyrometric means.

American Steel & Wire Co., Chicago and New York, has issued a new catalogue of electrical wires and cables. This is a very complete edition comprising 84 pages of which the first 50 give detailed information and illustrations of the various types of wire and cables made. Included among these are magnet, annunciator and office wire, Reliance weatherproof, slow-burning and weatherproof iron wire and cable, various types of lamp cords, Americore rubber-covered wire for interior wiring, Amerite rubber-covered wire for high voltages, lead-covered and steel-armored cables, submarine cables, rail bonds, galvanized iron telephone and telegraph wire and steel strands. Then follow about 12 pages of useful wire data, including tables giving comparisons of the various wire gauges, data on stranded wires and cables, resistances and weights of wires and carrying capacity of wires, the physical properties of different wires and metals and general physical data are given, also several tables of standard shipping reels. Sixteen pages are devoted to five illustrated articles on systems of wiring by F. H. Bernhard, engineering editor of the ELECTRICAL REVIEW; these deal with modern house wiring, wiring of farm buildings, industrial plant wiring, labor costs for installing conduit wiring systems, and protective grounding of lighting and power circuits and equipment. The last five pages of the catalog give a very condensed outline of the principal products made by the American Steel & Wire Co., including its electrical wires, airplane wires and cables, auto cables, wire wheels, wire rope, aerial tramways, barbed wire, poultry netting, wire fences, piano wire, wire tacks, door springs, flat wire and steel, bale ties, steel fence posts, wire hoops, re-enforcement, etc.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Springfield, Mass.—The New York, New Haven & Hartford Railroad Co. has awarded a contract for the construction of a new boiler plant at its local yards.

Waterbury, Conn.—The American Brass Co., Grand and Meadow streets, has awarded a contract to the Torrington Building Co., Torrington, for the construction of a new one-story pumping building at its plant. The structure is estimated to cost $10,000.

Albany, N. Y.—The General Carbonic Co., Mill and Bridge streets, has awarded a contract to the William G. Sheehan Construction Company, 28-30 DeWitt street, Albany, for the erection of a new extension to its boiler plant to provide for increased operations.

Buffalo, N. Y.—It is understood that the Finance Committee of the Board of Supervisors is considering plans for the employment of a power plant expert for the designing of lighting, heating, and ventilation plants for use at the proposed new county home and hospital.

Canisteo, N. Y.—The proposition to issue $15,000 for municipal lighting was defeated. The majority of the business men are in favor of a deal with the Hornell Electric Co., which agrees to build a line to Canisteo and to supply unlimited power if the people in Canisteo will take $9500 worth of the company's bonds.

Jamestown, N. Y.—The Common Council has approved the merger of the Home Telephone Co. with the local branch of the Bell system, effectitve April 1, to be known as the Jamestown Telephone Corporation.

Mineola, N. Y.—The Nassau Light & Power Co. is arranging plans for extensive improvements in its system to Manhasset, L. I., for increased operations. It is understood that extensions will be made in the electric street-lighting system in the Port Washington district. Frederick Maidment is president.

New York, N. Y.—The Federal Court has appointed James R. Sheffield, of New York, a well-known lawyer and formerly Assemblyman, receiver for the Interborough Consolidated Corporation, which holds a majority of the stock of the Interborough Rapid Transit Co. and the New York Railways Co., which recently went into receivership.

New York, N. Y.—Announcement has been made that a serious situation will result should the Board of Estimate not approve the appropriation of $557,060 recently requisitioned by the Public Service Commission for the continuance of subway construction work for the second quarter of the year. It is said that the need for the appropriation is very urgent, and unless taken care of at an early date a total of about 1000 employes will automatically become idle. Travis H. Whitney is acting chairman of the Commission.

Camden, N. J.—Wilckes, Martin & Wilckes, manufacturers of lamp black, etc., have completed plans for the rebuilding of its two-story drying building, located at the head of Pine street, recently destroyed by fire. Frank Sutton, 80 Broadway, New York, is engineer for the company.

Newark, N. J.—The Board of Public Utility Commissioners has granted permission to the Public Service Railroad Co., a subsidiary of the Public Service Corporation, to issue stock to the amount of $30,000. It is understood that a portion of the proceeds will be used for various improvements.

Pompton Lakes, N. J.—The Borough Council is making rapid progress on the construction of the new borough electric plant, and it is understood that operations will be inaugurated about the middle of April. The Board of Works is working on schedules of rates for service for supplying Pompton Plains, Riverdale, and neighboring sections from the new plant.

Allentown, Pa.—The Lehigh Valley Transit Co. has completed the issuance of bonds for $15,000, a portion of the proceeds to be used for extensions and improvements in its system. Notice has been filed with the Public Service Commission.

Beatty, Pa.—The Board of Managers of St. Vincent's College is having revised plans prepared for the construction of the proposed new power plant at the institution. The structure will be one-story, brick, and with equipment installation is estimated to cost about $200,000. The Joseph A. Langdon & Sons Co., Grant street, Pittsburgh, is consulting engineer.

Coatesville, Pa.—The Chester Valley Electric Co. has filed notice with the Public Service Commission of the issuance of bonds for $82,000, a portion of the proceeds to be used, it is understood, for extensions and improvements in its plant and system.

Mauch Chunk, Pa. — The Mauch Chunk & Lehighton Transit Co. has completed arrangements for the installation of a quantity of new equipment in its power plant, to provide for increased operating facilities. The company is also planning for improvements in its power lines, and the installation of new motors in its rolling stock, in connection with other improvements. Ives & Davidson, 61 Broadway, New York, electrical engineers, have been retained by the company in charge of the work.

New Castle, Pa.—The Mahoning & Shenango Railway & Light Co. has filed notice with the Public Service Commission of the issuance of bonds for $217,000, to provide for general improvements, expansion, etc.

Oil City, Pa.—The City Council is planning for the construction of a one-story boiler plant to cost about $45,000.

Middletown, Md.—Middletown Packing Co. is erecting a one-story addition to its plant, 32x200 ft. in size. Boiler equipment, pumping machinery, power transmission apparatus and other equipment will be installed.

Moundsville, W. Va.—C. McKinley Co. is planning the installation of electrically operated equipment to replace the former steam-driven apparatus in connection with rebuilding its coal tipple recently destroyed by fire.

Albany, Ga. — Georgia-Alabama Power Co. is considering the construction of a new hydroelectric power plant on Flint river, with an initial capacity of about 10,000 hp.

NORTH CENTRAL STATES.

Berlin Heights, Ohio—The Lake Shore Electric Station and Subpower House were destroyed by fire. Loss $15,000, covered by insurance.

Mt. Union, Ohio—The council is planning ways and means to establish a municipal light plant. Address city clerk.

Norwalk, Ohio—The city officials will ask electrical companies to submit bids for the 500-kw. generator and condensers for the light and power plant as soon as the attorney for Sidney Spitzer Co. finds the ordinance for the sale of the bonds all right. The sale of the bonds at premium of $1202 pleased officials of the city and others.

Oxford, Ohio.—Specifications have been prepared for electric pumps for water system. Address J. H. Hughes, mayor.

Tiffin, Ohio.—The Central Power Co. is seeking a contract to furnish service to Bucyrus. The proposition of the company is to extend its high-tension wires from Shelby to Bucyrus, connecting with Crestline and Galion. The Pennsylvania shops at Crestline are wanting power from the company and it is thought arrangements could be made to serve Galion. E. D. Wagenhaus is general manager.

Wooster, Ohio.—Service Director H. H. Miller is advertising for the contract for lighting the streets of Wooster. A municipal lighting plant will eventually be built here.

Anderson, Ind. — A seven-story

hotel will be erected at corner of Main and Ninth streets, by T. N. Stilwell, A. Weslow and E. C. Love. The new hotel will contain 184 rooms.

Colfax, Ind.—Colfax Electric Co. has organized. Electric lights for Colfax are now assured. George Davis, president.

Indianapolis, Ind.—The city is considering the installation of new arc lighting units at various locations in the street-lighting system in Indiana avenue.

South Bend, Ind.—Thor Electric Co. is remodeling both the interior and exterior of its business house. The sales and display room for electrical merchandise will be greatly enlarged and made attractive by the changes.

Washington, Ind.—City has petitioned Indiana Public Service Commission for permission to issue bonds in the amount of $20,000 for improvement of lighting and power plant.

Winamac, Ind.—The Winona Telephone Co. will spend $12,500 on improvements. Address W. E. Danils, Knox, Ind., secretary.

Bloomington, Ill.—Illinois Tractor Co. will erect power plant. Address J. G. Sinclair, chief engineer.

Bloomington, Ill.—Union Gas & Electric Co. will expend $50,000 for improvements. The Engineering Department of the company is now working on plans for a new boiler house which will contain three large new boilers and a new exhauster house which will take the place of the one now in use. Address Manager Roy Stretch.

Decatur, Ill.—Decatur Malleable Iron Works plans the erection of a $100,000 shop building.

Gillespie, Ill.—Southern Illinois Light & Power Co. has taken first steps in the erection of an $80,000 power plant in this city. It is expected that the plant will be ready for operation before next winter. When the company was given a light and power franchise in Gillespie one of the provisions of the grant was that a power plant would be erected in this city. For a few years the company served Gillespie through high tension wires, but the plant will now be erected in accordance with the terms of the franchise.

Lincoln, Ill.—The Lincoln Telephone Co. has petitioned the Illinois Public Utilities Commission to purchase the Central Illinois Telephone & Telegraph Co. at Lincoln; the New Holland Telephone Co. at New Holland, and the Elkhart Independent Telephone Co. at Elkhart. The company also asks permission to issue $152,500 of its capital stock.

Rock Island, Ill.—The Rock River Valley Light & Power Co. has filed a petition with the Illinois Public Utilities Commission asking for a certificate of convenience and necessity to construct and operate a light and power plant in Barstow, Joplin and Hillsdale, Ill., and to issue $20,000 of its capital stock.

Rockford, Ill.—Rockford & Interurban Co. has installed a transformer at the village of Rockton and will furnish light and power.

DATES AHEAD.

Tri-State Water and Light Association. Annual meeting, Greenwood, S. C., April. Secretary-treasurer, W. F. Steiglitz, Columbus, S. C.

Pacific Division, N. E. L. A., Pacific Division, National Electrical Jobbers' Association and California Association of Electrical Contractors and Dealers. Joint convention, Coronado, Cal., April 30 to May 2.

National Fire Protection Association. Annual meeting, Ottawa, Ont., May 6-8. Secretary-treasurer, Franklin H. Wentworth, 87 Milk street, Boston, Mass.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 12, 13 and 14. Headquarters, Hotel Galvez. Secretary, H. S. Cooper, 403-404 Slaughter building, Dallas, Tex.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 19-23. Secretary, T. C. Martin, 33 West 39th street, New York City.

Illinois Association of Electrical Contractors and Dealers. Summer convention, Decatur, Ill., June. Secretary, N. M. Blumenthal, 179 West Washington street, Chicago.

American Society of Mechanical Engineers. Spring meeting, Hotel Statler, Detroit, Mich., June 17-20. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Electrical Engineers. Annual convention, week of June 23, Adirondacks, N. Y. Headquarters, Lake Placid Club. Secretary, F. L. Hutchinson, 33 West 39th street, New York.

National Association of Electrical Contractors and Dealers. Annual convention, Milwaukee, Wis., July 15, 16 and 17. General manager, William H. Morton, 110 West 40th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 15-18. Headquarters, Breakers Hotel. Secretary, D. L. Gaskill, Greenville, Ohio.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., September, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

Springfield, Ill.—Central Illinois Public Service Co. has opened an office in Springfield, the ground floor of the Farmers National Bank building having been leased by the company. The offices of J. Paul Clayton, vice-president; P. A. Erlach, auditor; and Carl Cripe, treasurer, have been removed to Springfield from Mattoon, Ill.

Detroit, Mich.—Detroit United Railway is interested in a project for an electric line from Flint to Davison and Potter's Lake, with continuation to Elba, Lapeer and Imlay City. Address F. W. Brooks, general manager, Detroit, Mich.

Marine City, Mich.—Banner Salt Co. will erect a new one-story power plant, 50x100 ft.

St. Joseph, Mich.—Preliminary plans for the erection of a new boiler plant to cost about $30,000 are being prepared by the Mullen Brothers Paper Co.

Tipton, Mich.—A meeting was held here in regard to the electric light proposition and it seems to be almost a certainty that the village will soon be lighted with electricity, the power to come from Clinton. Address village clerk.

Tuscola, Mich.—The council has been petitioned for a franchise to supply electric lighting. Address village clerk.

Cumberland, Wis.—Clear Lake Electric Co. has purchased the electric plants at Glenwood City, Downing and Boyceville from the Wisconsin-Minnesota Light & Power Co. These plants are now run by steam, but will be connected with the power plant at Little Falls on Apple river as soon as high tension lines can be erected.

Janesville, Wis.—Bids are being taken by the Parker Pen Co. for the erection of a new three-story factory, office and power plant, designed by Frank A. Carpenter, architect, Rockford, Ill., and estimated to cost $100,000. New machinery and equipment will be purchased.

SOUTH CENTRAL STATES.

Dixon, Ky.—Twenty-eight citizens of Dixon have made a contract with the Clay Light & Ice Co. to furnish the county seat with electric lights. Poles will be erected and wires strung from Clay to Dixon.

Ghent, Ky.—Ghent Electric Light Co. has organized with a capital of $5000. It is proposed to light the streets and private residences.

Louisville, Ky.—Reciprocating Electric Tool Co. has increased its capital from $10,000 to $100,000.

Louisville, Ky.—The commercial department of the Louisville Gas & Electric Co. during the week ended March 21 secured 71 new electric light and power customers with 27 kw. of lighting and 46-hp. in motors, and closed contracts for wiring 32 already built houses. New business connected to the company's lines shows an increase of 61 customers with 38 kw. of lighting and 9-hp. in motors. Output of electric energy was 9.4% greater than during the corresponding week a year ago.

Chattanooga, Tenn.—The power station of the Chattanooga Railway & Light Co. was completely destroyed by fire recently, a loss of $50,000 being sustained.

Memphis, Tenn.—The Rosemark Telephone Co. has recently filed notice with the secretary of state of an increase in its capitalization to $25,000 to provide for general business expansion.

Blytheville, Ark.—The Missouri Southeastern Utilities Co. is said to be planning for the construction of a large new power plant. It is understood that the company has completed arrangements for furnishing electric power to eight cities located in this section.

Paragould, Ark.—Plans are under consideration by the City Council for the construction of a new municipal electric light plant. The project is estimated to cost in the neighborhood of $100,000.

Monroe, La.—The city is considering plans for increasing the capacity of the municipal electric light and power plant.

Ada, Okla.—The Oklahoma Power & Transmission Co. is arranging

plans for the extension of its transmission system from Ada to Sulphur and Davis.

Marietta, Okla.—The city is having plans prepared for improvements and extensions in the municipal electric light and water plants. Bonds for $15,000 to provide for the cost of the work have been authorized.

Miami, Okla.—The Southwestern Light & Power Transport Co., Commerce Building, has completed arrangements for the construction of its new hydroelectric power plant on the Grand river. The work will include the construction of seven dams, of 15,000 hp. capacity each, with an auxiliary plant of 10,000 hp. capacity at Miami. The company is planning for the installation of a new 10,000-hp. steam turbine at an early date. W. T. Croslen is president and chief engineer; W. S. Miller is vice-president, and J. H. Stewart is secretary-treasurer.

El Paso, Tex.—The city is considering plans for the installation of new arc-lighting units along the Scenic Drive on the Mesa. Charles Davis is mayor.

WESTERN.

Miles City, Mont.—The City Council is considering plans for the installation of a quantity of new equipment in the municipal electric light plant, in connection with other improvements, the work being estimated to cost $45,000. J. J. McGill is superintendent.

Wibaux, Mont.—Eastern Montana Light & Power Co. plans to improve and build additions to its plant to supply the towns of Wibaux and Glendive, also Beach, N. D. H. Zopf, manager.

Flagstaff, Ariz.—Progress is being made in the big project of constructing a dam across the mouth of Diamond Creek, in the Grand Canyon of the Colorado river, the installation of a big hydroelectric plant and the construction of a system ot power transmission lines, according to James McGirand, chief engineer of the Grand Canyon Power & Development Co., and its affiliated corporation, the Hualpai Syndicate of New York. It is stated that one of the primary purposes of the proposed hydroelectric plant is to provide power for operating trains on 500 miles of railway of the Atchison, Topeka & Santa Fè system in Arizona. Power will also be furnished many of the cities and towns of the State. It is estimated that the cost of the dam and transmission system will be approximately $12,000,000.

Lamar, Colo.—The town officials have petitioned the State Public Utilities Commission for permission to establish a municipal electric light plant.

Spokane, Wash.—An order for the sale of the assets of the Spokane Heat, Light & Power Co., operating in the hands of a receiver, at public auction, April 21, was issued by United States District Judge Frank H. Rudkin here today. A minimum bid of $250,000 was set by the court, but first bonds outstanding against the company, held by eastern electrical concerns, total $1,400,000. The company is capitalized at $3,500,000.

Salt Lake City, Utah.—The Commercial Club has appointed a committee to further the plan for the installation of a lighting system along the Salt Lake to Ogden highway to be ready for use at the same time the new concrete road is finished. Arrangements have been made for the compilation of costs for installation and maintenance of the system, by Wesley E. King, chairman of the committee. This information will be turned over to the county commissioners of the counties through which the road goes.

Astoria, Ore.—The Pacific Power & Light Co. is planning for the installation of a quantity of new equipment in its plant, to provide for increased capacity. It is understood that a new 3750-kva., 660-volt, 3-phase steam turbo generator is included in the work, the entire being estimated to cost $400,000.

Astoria, Ore.—Pacific Power & Light Co. will install one 3750-kv-a., 6600-volt, 3-phase steam turbogenerator in the station at Astoria. The present steam boiler installation will be increased by 2000 hp. in boilers. The new plant will represent an investment of $400,000.

Klamath Falls, Ore.—California-Oregon Power Co. has decided to proceed with the construction of dam across the head of the Link river in accordance with the terms of a contract with the government for use of the power house at Copco, Cal.

Fresno, Cal.—The San Joaquin Light & Power Co. is arranging plans for the early construction of a large new power plant on the San Joaquin river, to be known as San Joaquin plant No. 6. The plant will be located in the vicinity of Macy flat, about six miles below the present plant, and will have a capacity of about 20,000 hp. The company is planning to complete the work within a year. The project is estimated to involve an expenditure of over $1,500,000.

Los Angeles, Cal. — The Pacific Electric Railway Co. has awarded a contract to the Renard & Stary Electric Co., Los Angeles, for electrical work, including conduit wiring and the installation of necessary fixtures, etc., for buildings, pits and tunnels in the vicinity of Torrance. The work is estimated to cost $12,999.10.

Redding, Cal.—The Pit River Power Co. has filed articles of incorporation with a capital of $2,500,000 to engage in the development of electric energy for the Southern Pacific Railroad Co. It is said that the company will be affiliated with the latter organization.

PROPOSALS

Electric Bridge Cranes.—Bids will be received until April 14 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of electric bridge cranes in machine shop addition at Boston, Mass., to cost about $175,000. (Specification 3477.) A deposit of $10 will be required for plans and specifications.

Electrical Equipment.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 7 for installing electrical equipment at Pensacola, Fla., to cost about $30,000. (Specification 3785.) A deposit of $10 is required for plans and specifications.

Electric Dumb Waiter. — Sealed Bids will be opened in the office of the Supervising Architect, Treasury Department, Washington, D. C., at 3 p. m., April 17, for the installation complete of a hoistway and electric dumb waiter in the United States Post Office and Court House at Pittsburgh, Pa., in accordance with the drawing and specification, copies of which may be had at the above office in the discretion of the Supervising Architect, James A. Wetmore, acting supervising architect.

Electrical Supplies.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for the following: bells and buzzers, portable, salvo-firing buzzers, delivery East and West (Schedule 3858); 100 140 A. H., 120 volt storage batteries, delivered in East (Schedule 3880); and 11,000 ft. interior communication cable, delivery at Brooklyn, N. Y. (Schedule 3889).

Cable and Wire.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for miscellaneous quantities of flexible, brush-holder cable and single conductor, ignition cable, for delivery East and West 500 ft. searchlight cable, delivery at Boston, Mass. (Schedule 3895); miscellaneous quantities of hard brass wire, hard and soft copper wire and bronze phosphor wire, delivered East and West (Schedule 3894); and magnet wire, for delivery East and West (Schedule 3895).

Pipe, Valves, Insulation Covering, Etc.—Bids will be received until 8 p. m., April 7 at Virginia, Minn., for the construction of a distribution system, for the municipal central heating system, and pipe, valves, insulation covering, etc. Address Edward Wenzel, secretary, Water and Light Commission.

Pumping Equipment.—Bids will be received until 2 p. m., April 10 at Mitchell, S. D., for constructing a pump station building, well houses, machinery foundations, etc.; pump station equipment, including one 2,000,000 gal. triple expansion pump, Uniflow engines and generators, one 125 h. p. boiler and auxiliaries, 10 motor-driven centrifugal pumps, 8 motor-driven well pumps, complete air lift system, three 12-in. wells, one 48 in. by 90 ft. Brick or concrete stack, one 200,000 gal. tank on 125 ft. tower, etc. Address R. E. Davis, city auditor.

Pumps.—April 8 bids will be received for improving the water system at High Point, N. C. The specifications include electrically driven centrifugal pumps and incidental piping and appurtenances to make the work complete. Address D. A. Stanton, mayor.

Personal

Col. Carty Awarded Distinguished Service Medal—Guy A. Richardson Joins Philadelphia Rapid Transit—Changes

R. E. BROWN, manager of the Northern States Power Co., Mankato, Minn., division, has been elected vice-president of the Minnesota Electric Association for the ensuing year.

BURTON GIBSON, representative of the Edison Electric Appliance Co., has left for the Hawaiian Islands to represent the three divisions of his company, with headquarters both at Honolulu and Hilo.

CHARLES C. RAND, formerly connected with the United States Bureau of Standards, Pittsburgh, has accepted a position with the National Lamp Co., Cleveland, as research chemist, and will assume his new duties shortly.

J. R. LOWE, who is well known in steam engineering circles in the South, was recently appointed representative of the Midwest Engine Co., Anderson, Ind., at its New Orleans (La.) office, and will handle the pump, oil engine and turbine business of the company in that territory.

G. W. SHANER, for some time connected with the Westinghouse Electric & Manufacturing Co., at San Francisco, has associated himself with the Utah-Idaho Central Railroad at Ogden, Utah. This company is building a new substation at Ogden, among whose equipment will be a motor-generator set of special type.

FRANK L. ELDRIDGE, who for the past four and a half years has been special representative of the Kellogg Switchboard & Supply Co., has associated himself with the French Battery & Carbon Co., Madison, Wis. Mr. Eldridge will be in charge of the sale of dry cells and will have offices at 20-24 West Washington street, Chicago.

J. G. DE REMER, formerly vice-president and chief engineer of the United Light & Power Co. of San Francisco, subsequently consulting engineer for the American District Steam Co. and recently with the U. S. Shipping Board as a member of the ship protection committee, recently returned to San Francisco where he will establish a research laboratory to investigate various electrical and mechanical problems which he formerly had under way in New York City.

CLARENCE R. YOUNG has resigned his position as sales manager of the Pacific Power & Light Co., Portland, Ore., to accept a position in the securities department of the Electric Bond & Share Co. at New York. Mr. Young served the Pacific Power & Light Co. for eight years in the following positions: Chief clerk to the purchasing agent, chief clerk to the vice-president and general manager, and sales manager. He was graduated from Stanford University as a civil engineer in 1910.

HOMER C. BENDER has been appointed superintendent of public utilities of Spokane, Wash. He will be engaged in making personal investigations, gathering data, inspecting utility work under way and in preparing for rate and other hearings before the Public Service Commission. Mr. Bender is a graduate of the Massachusetts Institute of Technology and was for four years conected with Stone & Webster.

J. J. CARTY, colonel in the United States Army Signal Corps and chief engineer of the American Telephone & Telegraph Co., recently had conferred on him the distinguished service medal

Colonel J. J. Carty.

by General Pershing at Chaumont. The order conferring the decoration says: "Colonel Carty, by his brilliant professional attainments and sound judgment, has rendered services of exceptional value to the Government." Colonel Carty entered the telephone field in 1879, starting work in the Bell system with the Telephone Dispatch Co. of Boston. In 1887 he took charge of the Western Electric Eastern Cable Department, and later of the Western Electric Eastern Switchboard Department. Two years later he became chief engineer of the New York Telephone Co., then the Metropolitan Telephone & Telegraph Co., and while in this position, twice directed the technical work in connection with the reconstruction of this company's plant. In 1907, he became chief engineer of the American Telephone & Telegraph Co., the civilian position he now holds. Colonel Carty has been the recipient of many honors conferred by American colleges, scientific and engineering societies. He is a member of many of these organizations and has served as president of the American Institute of Electrical Engineers and the New York Electrical Society.

IRA W. MCCONNELL has become associated with Dwight P. Robinson & Co., Inc., constructing and consulting engineers, 61 Broadway, New York City, in the capacity of vice-president. Mr. McConnell graduated from Cornell University with the degree of civil engineer in 1897. He was thereafter for two years instructor in the College of Civil Engineering at Cornell, and one year professor of civil engineering at the Missouri School of Mines, Rolla, Mo.

Mr. McConnell's engineering practice has included an unusually wide variety of technical, executive and administrative work covering practically all sections of the United States and Southern Canada. For two years following graduation he was employed in routine technical work at surveying, topography, hydrographic work, water supply and sewer design and construction. As contractor's superintendent for the Nash-Dowdlo Co., of Chicago, he was employed for two years on railway terminal work in Chicago and municipal drainage work in New Orleans. He was for six years in the United States Reclamation Service; four years as project and construction engineer, two years as supervising engineer of the central district. He was closely identified with the organization work of the Reclamation Service during the early years of its inception and was in charge of the work on the Uncompahgre Project and the Gunnison Tunnel. As supervising engineer reporting to the chief engineer he had charge of the Reclamation Service work in Oklahoma, Kansas, Colorado, Nebraska, Central and Southern Wyoming and South Dakota. This assignment in addition to the Uncompahgre Project, included such notable projects as the Pathfinder Dam, the North Platte Project, the Grand Valley Project in Colorado, the Belle Fourche Project in South Dakota, the Garden City Project in Kansas, together with the general supervision of Reclamation Service work in that territory.

In 1909, Mr. McConnell became chief irrigation engineer for J. G. White & Co., Inc., of New York, and later vice-president and general manager of the Idaho Irrigation Co., at Richfield, Ida. In February, 1912, he was employed by the Stone & Webster Engineering Corporation as consultant in connection with the design, construction and operation of public utilities, water powers, railways, steam power stations industrial buildings, etc. During 1916, he made a five months' study of general business conditions in South America, the trip covering the developed portions of Brazil, Uruguay, Paraguay, Argentine, Chile and Peru. In 1917, Mr. McConnell became chief engineer for Stone & Webster, and later works manager and assistant general manager for the American Shipbuilding Corporation at the Hog Island Shipyard.

A. H. KAHN, general purchasing agent Pacific States Electric Co., headquarters San Francisco, recently visited the Seattle and other Northwest houses of the company.

JOHN S. BLEECKER, formerly general manager of the Columbus Power Co., Columbus, Ga., is now general manager under the receiver of the New Orleans Railway & Light Co.

G. S. KIBBEY has returned from France after being given honorable discharge from the U. S. Engineers and resumed his duties as head of the Kibbey Engineering Co., Plymouth building, Minneapolis.

J. F. MACKIN, formerly with the Independent Pneumatic Tool Co., has accepted a position with the Black & Decker Manufacturing Co., of Baltimore, as representative throughout the entire state of Ohio.

C. RAYMOND CHACE, operating engineer, and formerly of the General Electric Co., Pawtucket, R. I., has received his discharge from the Ordnance Department, U. S. Army, and has taken a position with the Stone & Webster Engineering Corporation.

H. H. CLARK, who has served as a major in the Chemical Warfare Service during the war, and formerly electrical engineer of the United States Bureau of Mines, has returned to civil life as chief engineer of the Witherbee Igniter Co., Springfield, Mass.

J. B. FISKIN, chief engineer for the Washington Water Power Co., Spokane, Wash., attended a meeting of the Seattle Section of American Institute of Electrical Engineers on the evening of March 29, and read a paper entitled, "The Engineer—His Composition, Opportunities and Duties."

MARK M. JONES, in charge of employment for the Thomas A. Edison interests, West Orange, N. J., was the principal speaker at the meeting of the Labor and Employment Committee, held on March 27, at the Y. M. C. A., Perth Amboy, N. J. Mr. Jones spoke on the subject of "Labor Problems of the Present."

C. D. WILLIAMS, former assistant manager of the Stuart-Howland Co., Boston, Mass., electrical supply jobber, has joined the Efficiency Electric Co., East Palestine, Ohio, as general sales manager. Prior to his connection with the Stuart-Howland company, Mr. Williams was sales manager of the Simplex Electric Heating Co., and previous to that time he was in the employ of the Western Electric Co.

A. L. HUMPHREY, who has been vice-president and general manager of the Westinghouse Air Brake Co., Wilmerding, Pa., since 1909, has been elected president, succeeding John F. Miller. Mr. Humphrey is known as one of the leading manufacturers in this country and has been connected with the Westinghouse company since 1903, when he was appointed western manager with headquarters at Chicago.

DAVID W. HENDERSON, head of the transportation department of the Seattle street car lines of Puget Sound Traction, Light & Power Co., has been appointed superintendent of the municipal railway system of Seattle by Thomas F. Murphine, superintendent of public utilities, and will assume his new duties when the transfer of the traction lines to the city is made, on April 15.

GUY A. RICHARDSON, former general superintendent of operating department of Puget Sound Traction, Light & Power Co., Seattle, and recently appointed superintendent of transportation of Philadelphia Rapid Transit Co., will assume the duties of the latter position early in April. Mr. Richardson, now 36 years of age, is a native of Boston, where he began as motorman on the street railways about 20 years ago. In the steady advance made to the high place now attained, he has seen service also as repair-shop helper, power-station fireman and engineer, and during that period he studied electrical engineering, and as a result obtained a position of assistant in the office of the company's electrical engineer. After serving later as repair-shop superintendent for the Bay State railroad, he was sent to Michigan by Stone & Webster interests as assistant superintendent of the Houghton County Traction Co., and later was promoted to the superintendency. Leaving the last-named position in 1909, he went to Seattle where he served the Puget Sound Traction, Light & Power Co., first as assistant superintendent, then as general superintendent in charge of all the company's operations pertaining to its railways. In his new

Guy A. Richardson.

position Mr. Richardson will have control over the operations of 700 miles of street railway, using 4,000 cars and employing over 7,500 persons. He leaves the Puget Sound company practically at the time its Seattle street-car lines are being transferred to the municipal government.

OBITUARY.

WILLIAM H. DEVEAU, for many years manager of the New Rochelle, N. Y., branch of the New York Telephone Co., died on March 25, at the home of his nephew, Samuel H. deVeau, in Mamaroneck, N. Y.

GEORGE W. WILSON, of Buffalo, N. Y., connected with the International Railway Co. of that city for the past five years in the capacity of treasurer, died on March 18, following an illness of about six weeks. Mr. Wilson was in his fifty-first year.

CHARLES T. JAEGER, a pioneer in the miniature lamp industry, died suddenly at his home in Brooklyn, N. Y., from pneumonia. He was the brother of Herman J. Jaeger, of the H. J. Jaeger Co., Weehawken, N. J. The deceased retired from active business about five years ago. He is survived by his widow and three children.

F. M. GRANT, president of the F. M. Grant Electric Co., electrical contractor and engineer, Cleveland, Ohio, passed away on March 21 after a brief illness. Mr. Grant was formerly associated with the Erner Electric Co., of Columbus. Ohio, and entered business in Cleveland five years ago with W. C. Harrington. He leaves a widow and a daughter.

JOHN J. CUMMINS, former president of the Syracuse Lighting Co., Syracuse, N. Y., and for many years prominent in the business circles of that city, died on March 17. He had been in poor health for several years and a short time ago suffered an attack of pneumonia, after which he sank rapidly. Mr. Cummins entered business as an office boy in the wholesale dry goods house of Neal & Hyde, advancing rapidly until he became financial man for the concern. After 25 years' service he left the company to become president of the Syracuse Lighting Co. In 1909 Mr. Cummins resigned as president of the lighting company and became interested in a contracting firm with several others. Besides his widow, he is survived by one son and two sisters.

MAJ. JAMES ALFRED ROOSEVELT, electrical engineer, and cousin of the late Colonel Theodore Roosevelt, died suddenly on March 26, while he was returning from active duty in France. Mr. Roosevelt was stricken with cerebro-spinal meningitis aboard the naval transport *Great Northern* and expired when only 400 miles off Sandy Hook.

Major Roosevelt was born in New York City in February, 1885. Shortly after leaving Harvard he formed the engineering firm of Roosevelt & Thompson, at 80 Broadway.

In 1907, when a difficult problem in railroad engineering developed in the operation of the Third Avenue Railroad system in New York City, young Roosevelt was called in. He solved the problem and accepted the post of general superintendent. He held that position for four years.

In 1911 he was appointed to direct the system of street railway and interurban electric lines of the British Columbia Company, with headquarters in Vancouver, B. C. The Victoria lines, as well as the Chiliwack, came directly under the management of Mr. Roosevelt. He also assumed control of the light and power companies in British Columbia operated as subsidiaries of the British Columbia Company. He introduced a number of new features in the management of the properties.

When the first Plattsburg Officers' Training Camp was opened in 1917, Mr. Roosevelt, then in New York again, applied for admission and was accepted. He came out at the end of the training period with a commission of captain of infantry and was assigned to the 308th Infantry, then being formed at Camp Upton. He went overseas with that unit. After seeing much action with the 77th Division, he was promoted to major and assigned to the divisional ammunition train.

When the New Yorkers were at the height of their fierce fighting for possession of the Vesle River, Major Roosevelt was cited for displaying exceptional bravery and courage under heavy fire.

Financial News

Federal Utilities Board Proposed.

The need for Federal action to stimulate the consideration by local authorities of applications by public utilities for higher rates growing out of increased operating expenses has been strongly emphasized during recent years. Several Government departments have under consideration the organization of a board to hear cases involving disputes over rates between local authorities and street car, gas and electric companies and other public utilities, and also to make recommendations. No legal power would be sought to provide for the carrying out of these recommendations, dependence being placed upon moral influence. While increased rates have been granted in many cases, city councils, utilities commissions and other local authorities have been slow to act on applications for higher rates to meet increased operating costs, according to reports to the War Finance Corporation, War Labor Board and Labor Department, with the result that many utilities face a serious financial situation. Conferences between officials of the Treasury, Labor Department and the War Labor Board have been held to find a solution for this problem and have suggested to President Wilson that he approve the formation of a voluntary board, composed of representatives of utilities, employes and Government departments, to hear appeals of utilities rates either from the company or public interests. The decision of the board would not be absolutely binding, but officials point out that its authority might be somewhat comparable to that of the War Labor Board as now constituted. Arguments against the plan presented by Government officials are that it might savor of extended Government interference with local business affairs. This situation has postponed adoption of the plan heretofore. About 100 public utility corporations have made application to the War Finance Corporation for loans to tide them over the period of financial stress caused by soaring operating costs. In most cases the company's financial conditions were regarded as not healthy, however, since adequate security could not be furnished, and assistance was not given. Only nine public utilities have obtained loans, aggregating $39,000,000, from the War Finance Corporation.

War Record of Utilities an Element of Great Strength.

W. H. Hodge, publicity manager of H. M. Byllesby & Co., in an article in the New York Evening Post Utilities number, says:

"The war record of electric and gas companies, particularly the large organizations and the multitude of smaller companies having capable management, will prove to be a recommendation of great strength in the future. While the reconstruction period will impose its own peculiar problems, these difficulties cannot possibly equal the conditions which these service companies faced and conquered during 1917 and 1918.

"The durable character of the utilities has again been emphasized by the vicissitudes which they overcame during the war, and it is already being reflected in the upward market trend of their securities. Generally speaking sensational advances in the prices of their securities are not to be anticipated, but in all probability there will be a steady climb back to and exceeding the top levels existing before the war and in 1916.

"A widespread, active construction period will hardly get under way in 1919, but next year should see unprecedented building, particularly of electric transmission lines, water powers and steam turbine power stations. Prices of money and materials are still too high to permit the construction of any except the most necessary extensions. No conservative utility operator will do any more financing at the existing high interest rate than he has to, nor will he buy machinery, wire, etc., for permanent construction until prices are much reduced, if it can be avoided.

"A time of wonderful expansion in the electrical industry cannot be long postponed, however, if the United States is to continue its course of industrial prosperity. The war brought to the foreground the dependence of modern production upon mechanical power, and the superiority and economy of electrical power produced by large central stations. Every power company in a manufacturing district was seriously pressed to supply additional industrial demands during the war, and it is safe to say that nearly all of the new business gained, or its equivalent, will be permanently retained, and the demands for electrical power will continue to grow with every factory expansion and the establishment of every new industry.

North American Pulp & Paper Financing.

A syndicate composed of British and French-Canadian bankers has underwritten the sale of $5,500,000 bonds of the Saguenay Power Co., a new corporation organized to take over all public utility properties controlled by the American Pulp & Paper Companies, which will still control these properties through the new concern. The proceeds will be used in part to liquidate debts, including money now owing to the parent company. In addition, the new company will extend its water power development. The construction program at Chicoutimi mills will be completed shortly and it is expected merchantable pulp capacity will be increased from 20,000 tons at present to 140,000 tons annually.

Cities Service Stock Bankers' Shares.

Henry L. Doherty & Co. and Montgomery & Co., as syndicate managers, are forming a syndicate to underwrite 200,000 Cities Service Co. common stock bankers' shares.

Each ten bankers' shares represent one share Cities Service Co. common stock which will be deposited with the Bankers' Trust Co. as trustee under a depositary agreement. Dividends paid in common stock on the deposited shares will be sold and dividends on the bankers' shares will be paid monthly in cash, the first dividend having been paid April 1 to bankers' shares of record March 15. The issue of these bankers' shares was made in response to a general request that some method be devised whereby Cities Service Co. common stock would be obtainable in smaller units than the shares of $100 par value which are now selling above 340.

New Standard Gas & Electric Bonds.

A syndicate comprised of Montgomery & Co., White, Weld & Co., and H. M. Byllesby & Co., Inc., is offering $1,500,000 Standard Gas & Electric Co. convertible 6% sinking fund gold bonds, at 96½ and interest. These bonds, dated Dec. 1, 1911, mature Dec. 1, 1926, interest is payable June 1 and Dec. 1 in New York, Chicago or Philadelphia. They will be secured, upon completion of the present financing, by deposit with the trustee of securities having a total par value of over $28,000,000 and a market value conservatively estimated to be in excess of $20,000,000. These bonds and $750,000 collateral trust 7% notes are senior to $28,181,963 par value of scrip, notes and stocks on $18,828,813 of which interest and dividends are being paid at the rate of 6% per annum. Semi-annual sinking fund payments, it is estimated, will retire before maturity not less than $1,194,000 bonds.

$4,000,000 Edison Bonds Sold.

The Commonwealth Edison Co. is floating a $4,000,000 block of the company's first mortgage 5% bonds, which are offered for public subscription at 93.25 and accrued interest, yielding approximately 5½%. The bonds are offered by thirteen Chicago banks and investment houses, the issuance being an addition to the company's $34,631,000 first 5s now outstanding. It is dated Sept. 1, 1908, and matures June 1, 1943.

Exports Establish High Record.

United States exports for eight months ended Feb. 28 last indicated that the total for the fiscal year, ending June 30 next will amount to $6,500,000,000, thereby establishing new high record.

Montana Power Report.

The annual report of the Montana Power Co. for the year ending Dec. 31, 1918, including the operation of Great Falls Power Co., Thompson Falls Power Co., Montana Reservoir & Irrigation Co., and Great Falls Water Power & Townsite Co., shows gross earnings for the combined companies as $7,609,868, an increase over 1917 of $697,504. During the year there was appropriated to depreciation reserve $400,000, and charges against this account to cover replacements, reconstruction, obsolescence and depreciation amounted to $198,487.71, resulting in a credit balance in this account of $1,547,368.12 at the close of the year.

The policy of the company during 1918 was to postpone, as far as possible, all construction not absolutely necessary, or which did not have as its aim the winning of the war, and aside from the completion of the Holter development and some substations and transmission lines under way at the beginning of the year, there was very little new construction done. Construction expenditures during the year amounted to approximately $750,000, covering the completion of the Holter plant, additions and extensions to transmission lines and local distributing systems, new substations and miscellaneous additions and improvements to generating stations, substations and gas and steam heating departments.

The company had in its treasury at the beginning of the year $5,938,000 of its first and refunding mortgage sinking fund 5% gold bonds, Series A, of which $5,300,000 were sold during the year and the proceeds were applied on the floating debt and in the purchase of $1,500,000 of Liberty Loan bonds of the third and fourth issues. Bondable expenditures made during the years 1917 and 1918 for permanent improvements, extensions and additions to the company's plants and property and the balance of construction of the new dams and power plants at Thompson Falls and Holter will entitle the company to the issuance of an additional $2,836,000 of first and refunding bonds, which together with the $638,000 of the bonds now in the treasury will provide sufficient funds for the liquidation of the remaining floating debt and for further improvements, extensions and additions.

The combined earnings of the companies for 1915, 1916, 1917 and 1918 are as follows:

	1915.	1916.	1917.	1918.
Gross earnings	$4,359,408	$6,244,905	$6,912,364	$7,609,868
Operating expenses and taxes	1,191,904	1,491,623	2,023,332	2,473,563
Net earnings	$3,167,504	$4,753,282	$4,889,032	$5,136,305
Interest charges	1,189,162	1,319,735	1,395,605	1,686,110
Surplus over charges	$1,978,342	$3,433,547	$3,493,427	$3,450,195
Reserve for depreciation	300,000	350,000	350,000	400,000
Balance to surplus	$1,678,342	$3,083,547	$3,143,427	$3,050,195

For the Readjustment Period—What?

XXXI.

AN OPEN LETTER

If the value of things people buy were established in the minds of the people, would there be the hesitancy in business we are now facing?

The individual producer is the one to say what price he must receive for his wares. His business judgment will not permit him to ask an excessive profit (that would invite competition and perhaps excess production with destructive results), and he certainly dares not quote prices which cannot return proper compensation to the capital and labor invested in his product.

Satisfactory sales must be based on confidence between the buyer and seller.

It is our belief that prices made effective for a specified period or season will establish confidence in prices.

We are therefore telling our buying public what our prices are and that there will be no change for a definite period. To make the plan effective, we have deemed it advisable to make the price period of not less than six months.

If every producer who is not already doing so will adopt this plan, making his prices known to the public by advertising as well as by individual quotation, we believe the confidence of the buying public will be restored and that the present enormous demand will be set into action. Perhaps the best examples of this published, open-price plan are:

1. The retail drygoods business of the country whose prices are known to every individual through publication in advertisements and through plain, figured tags on the goods in the stores.

2. The automobile industry which once every season names its price to the public for that season so that every individual, possible customer or not, is made familiar with the value of the article.

These two industries are perhaps the only two large industries whose business has been and is now active since the Armistice.

If the manufacturers of cement, of steel, producers of lumber and other building materials, manufacturers of clothing, food products and machinery, had followed this PUBLISHED-PRICE-FOR-THE-SEASON method and the prices of these commodities were firmly established in the minds of the public, there would not now be so marked a halting in business.

If you agree with this reasoning, will you not reply to this letter, saying that you will assist by every means at your command to induce your company, your industry, other businesses and industries to help establish confidence promptly by adopting a plan of action over this slogan—PRICES EFFECTIVE FOR SPECIFIED PERIODS OR SEASONS WILL ESTABLISH CONFIDENCE BETWEEN BUYERS AND SELLERS.

(Signed) Yours very truly,

CHARLES J. LANG,

President, Lakewood Engineering Co.,

Cleveland, Ohio.

I BELIEVE the ideas contained in the above are worth bringing before the electrical industries. In each line of business conditions vary greatly, making it impossible for some to accomplish what others can readily perform; but basic principles remain the same.

C. A. TUPPER *President*

INTERNATIONAL TRADE PRESS, INC., CHICAGO

Hamilton Beach Increases Capitalization.

The Hamilton-Beach Manufacturing Co. recently filed articles with the register of deeds, increasing the capital stock from $25,000 to $300,000. There will be 3,000 shares of stock of par value of $100 each of which number 50 shares will be preferred and 2,950 shares common.

Allis-Chalmers Bookings Large.

The bookings of new business by the Allis-Chalmers Manufacturing Co. for the month of March are at the same rate that has prevailed since the first of the year. Business for each of the three months has been fairly well balanced, averaging about $1,000,000 a month. If this rate is maintained, the year's shipments should range between $25,000,000 and $28,000,000.

Offer City of Seattle Bonds.

R. M. Grant & Co. and Hornblower & Weeks are offering $750,000 city of Seattle Municipal Light & Power Plant and System 5% bonds, dated March 1, 1919, due March 1, 1939. The price is 100 and interest.

General Gas & Electric Co.

Statement of net income of affiliated companies month of February, 1919, and comparison with previous year follows:

System.	1919.	1918.
Rutland	$10,381	$ 4,926
Northwestern Ohio	*2,991	*4,001
Sandusky	6,345	3,693
Sayre	2,093	1,866
Binghamton	7,085	6,656
New Jersey	5,515	3,715
Jersey Corporation	*706	*733
Interurban Gas Co.	*76	*273
Total	$27,646	$15,849

*Deficit.

Public Service Company of New Jersey Reports.

The annual report of the Public Service Corporation of New Jersey for the year ended Dec. 31, 1918, shows net income after charges and taxes of $1,820,430, equivalent to $6.06 a share earned on the $29,999,600 capital stock, as compared with net income of $2,377,399, or $7.92 a share in 1917.

The combined results of operations of the Public Service Corporation of New Jersey and subsidiaries for the year ended Dec. 31, 1918, compare as follows:

	1918.	1917.
Sub. com. opr. rev.	$52,997,838	$47,291,342
Net after taxes	16,059,454	16,751,973
Sub. com. balance after charges	4,211,443	4,849,841
Other income	1,891,667	1,729,865
Total income	$ 6,103,110	$ 6,579,706
P. S. C. of N. J. ch.	4,282,680	4,202,307
Net inc. after chgs.	$ 1,820,430	$ 2,377,399
Divs., P. S. C., of N. J.	1,799,976	2,339,968
Surplus	$ 20,454	*$ 22,560

*Deficit.

Earnings.

COLUMBIA GAS & ELECTRIC CO.

For the two months to Feb. 28: Gross, $2,289,393, decrease $143,592; net after taxes, $1,205,071, decrease $13,440; total income, $1,533,888, decrease $9427; surplus after charges, $828,301, decrease $18,899.

Dayton Power & Light Co. reports for January gross earnings of $271,626, compared with $195,477 for January, 1918; net earnings, $101,745, compared with $51,487. For the 12 months ended with January gross earnings were $2,506,878, compared with $1,898,526 for the corresponding period of 1918; net earnings, $819,036, compared with $602,582.

UNITED LIGHT & RAILWAYS.

Gross earnings of the United Light & Railways Co. and subsidiary companies for the 12 months ended Sept. 30 amounted to $8,905,335, compared with $7,355,010 in the corresponding period of 1917, according to figures made public by Bonbright & Co., Inc. Net earnings were $2,669,345, compared with $2,774,812. Dividends on the preferred stock (6%) amounted to $607,748, compared with $603,336.

ARIZONA POWER.

The Arizona Power Co., including the Arizona Steam Generating Co., reports for September gross earnings of $45,930, compared with $44,823 for September, 1917; net earnings $23,250, compared with $22,022. For the 12 months ended Sept. 30, gross earnings were $601,932, compared with $435,548; net earnings $307,317, compared with $275,671.

ASHEVILLE POWER & LIGHT CO.

A statement of earnings of the Asheville Power & Light Co. for the year ended Dec. 31, 1918, compared with the two previous years, follows:

	1918.	1917.	1916.
Gross earnings from operation	$527,544	$497,959	$456,947
Operating expenses, including taxes	325,189	282,244	269,775
Net earnings from operation	202,355	215,715	187,172
Other income	9,906	3,766	4,802
Total income	212,261	219,481	191,974
Interest on bonds	61,000	57,942	55,000
Other interest and deductions	1,001	1,002	401
Balance	150,260	160,537	136,573
Preferred stock dividends	37,779	37,539	36,520
Balance	112,481	122,998	100,053
Common stock dividends	60,000	60,000	60,000
Balance	52,481	62,998	40,053
Depreciation	35,000	35,000	35,000
Balance after depreciation	17,481	27,998	5,053

The gross earnings for the 12 months ended Dec. 31, 1918, as shown above were derived from various classes of business as follows:

	Amount.	Approximate percentage of total.
Electric light and power	$211,668	41
Street railway	267,906	50
Gas	47,970	9
Total	$527,544	100

KANSAS GAS & ELECTRIC.

	1918.	1917.	1918.	1917.
	Gross.		Net.	
Jan.	$ 253,654	$ 199,857	$ 85,545	$ 67,213
12 mos.	2,177,353	1,777,625	709,925	496,797

NEW ENGLAND POWER SYSTEM.

	1918.	1917.	1918.	1917.
	Gross.		Net.	
Jan.	$ 318,033	$ 261,358	$ 130,786	$ 52,860
12 mos.	3,613,955	2,698,190	1,400,806	1,070,768

UTAH POWER & LIGHT.

	1919.	1918.	1919.	1918.
	Gross.		Net.	
Feb.	$ 482,996	$ 461,198	$ 262,510	$ 245,276
12 mos.	5,610,670	5,309,822	2,973,602	2,733,753

VIRGINIA RAILWAY & POWER.

	1919.	1918.	1919.	1918.
	Gross.		Net.	
Feb.	$ 688,288	$ 608,730	$ 261,936	$ 291,477
8 mos.	5,450,504	4,808,645	1,797,468	2,207,180

SOUTHWESTERN POWER & LIGHT. (Subsidiaries.)

	1919.	1918.	1919.	1918.
	Gross.		Net.	
Jan.	$ 550,107	$ 484,887	$ 195,527	$ 194,754
12 mos.	5,757,052	4,736,640	2,103,619	2,056,250

WESTERN POWER.

	1919.	1918.	1919.	1918.
	Gross.		Net.	
Feb.	$ 406,016	$ 348,451	$ 252,697	$ 210,177
12 mos.	4,762,447	4,051,611	2,973,604	2,513,540

NIAGARA, LOCKPORT & ONTARIO POWER.

	1919.	1918.	1919.	1918.
	Gross.		Net.	
Jan.	$ 237,227	$ 243,119	$ 104,101	$ 74,938

SHAWINIGAN WATER & POWER.

	1918.	1917.	1918.	1917.
	Gross.		Net.	
12 mos.	$3,621,074	$2,902,210	$2,335,053	$2,149,367

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Mar. 25.	Bid Apr. 1.
Adirondack Electric Power of Glens Falls, common	6	17	12
Adirondack Electric Power of Glens Falls, preferred	6	72	72
American Gas & Electric of New York, common	10+extra	120	119
American Gas & Electric of New York, preferred	6	41	41
American Light & Traction of New York, common	..	240	259
American Light & Traction of New York, preferred	6	98½	98½
American Power & Light of New York, common	4	57	54
American Power & Light of New York, preferred	6	71	73
American Public Utilities of Grand Rapids, common	..	..	..
American Public Utilities of Grand Rapids, preferred	7	33	33
American Telephone & Telegraph of New York	..	104¼	103½
American Water Works & Elec. of New York, common	..	6	5½
American Water Works & Elec. of New York, particip	7	11	10
American Water Works & Elec. of New York, first preferred	..	54	62
Appalachian Power, common	..	7	2
Appalachian Power, preferred	7	..	12
Cities Service of New York, common	+extra	345	359
Cities Service of New York, preferred	6	79¼	79
Commonwealth Edison of Chicago	8	114	113
Comm. Power, Railway & Light of Jackson, common	..	18	20
Comm. Power, Railway & Light of Jackson, preferred	6	42	43
Federal Light & Traction of New York, common	..	9	9
Federal Light & Traction of New York, preferred	..	44	45
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	23	23
Middle West Utilities of Chicago, preferred	6	48	48
Northern States Power of Chicago, common	..	70	70
Northern States Power of Chicago, preferred	ex.div.7	91	89
Pacific Gas & Electric of San Francisco, common	..	52	52½
Pacific Gas & Electric of San Francisco, preferred	6	87	87
Public Service of Northern Illinois, Chicago, common	7	90	93
Public Service of Northern Illinois, Chicago, preferred	6	90	91
Republic Railway & Light of Youngstown, common	4	21½	20
Republic Railway & Light of Youngstown, preferred	6	58	58
Standard Gas & Electric of Chicago, common	..	29	29½
Standard Gas & Electric of Chicago, preferred	6	44	43
Tennessee Railway, Light & Power of Chattanooga, common	..	5	4½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	22	21
United Light & Railways of Grand Rapids, common	4	39½	39
United Light & Railways of Grand Rapids, preferred	6	71½	71
Western Power of San Francisco, common	..	17	17
Western Union Telegraph of New York	extra	86⅝	85
Industries—			
Electric Storage of Philadelphia, common	4	70	70
General Electric of Schenectady	8	156	155½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	47⅛	45¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	55	55